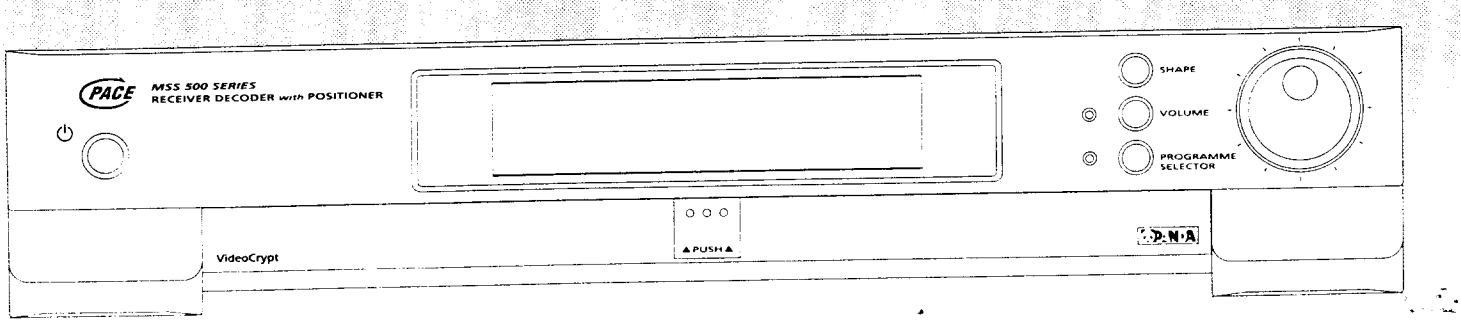
Service Manual

MSS 1000/500 SERIES
DISH POSITIONER MODULE

ALSO COVERS MSS-1008



PACE MICRO TECHNOLOGY LTD

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PRODUCT STATUS

The PCB described in this manual is at revision A3 which is denoted by the last three digits of the PCB part number. All circuit and PCB changes implemented on or before 05.12.94 are included in this manual.

There will be some units in the field fitted with dish positioner modules at PCB revision A2, the functionality has not changed but diodes D17 to D20 which were previously fitted to the underside of the PCB have been tracked in and are now fitted to the component side.

Details of further changes can be obtained in technical bulletins until this manual is re-issued.

OUTLINE SPECIFICATION

DISH POSITIONER

64 programmable satellite positions
Auto focus and satellite search features

Output to actuator motor	36 V dc (nominal)
Maximum continuous load	1 A rms
Intermittent load	2 A 20% duty cycle
Intermittent starting surge	3 A max (current limited)
Overload protection	Current limiting and foldback combined with thermal overload shut off.
Relay switching	15 A heavy duty relay
Position feedback type	Pulse counting
Pulse count range	0000 to 1999
Pulse repetition rate	1 pulse every 2 seconds minimum 80 pulses per second maximum
Compatible actuator types	Magnetic reed pulse generator Photo interrupter pulse generator
Reed switch operating current	1 mA (max) (5 V source)
Photo interrupter supply	+5 V dc/50 mA max (nominal)

POLARISER

Mechanical

Supply voltage	+5 V max, 150 mA
Control	0.8 ms to 2.2 ms wide pulses pulse repetition 33 per second
Control output	5 V p-p
Resolution	64 steps

Magnetic

Control current	0 to ±80 mA min, ±12 V max
Resolution	64 steps

Short circuit protected

CONNECTORS

8 push terminals

OPERATING/STORAGE CONDITIONS

Operating temperature range	5 – 40°C
Operating humidity	20 – 80% non-condensing
Storage temperature range	-20 – +50°C
Storage humidity	10 – 90% non-condensing

ACTUATOR CONNECTION

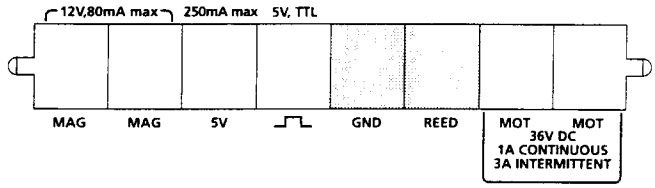
The actuator connectors used to drive the actuator unit of the dish assembly can be found on the left of the receiver's rear panel. Consult the instructions supplied with your actuator unit to determine where each of the coloured wires should be connected in the socket.

NOTE: The motor wires are generally thicker than the reed switch/optical feedback wires. If the dish moves in the opposite direction to that expected, then the motor (MOT) wires should be reversed.

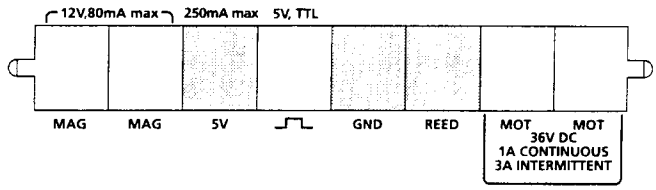
This Dish Positioner is compatible with the following types of actuator.

Reed Switch Actuator

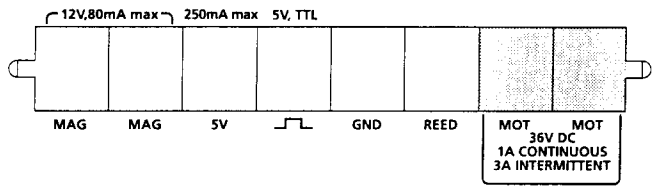
Shaded areas indicate which connectors to use.



Optical Feedback Actuator



Motor Wires

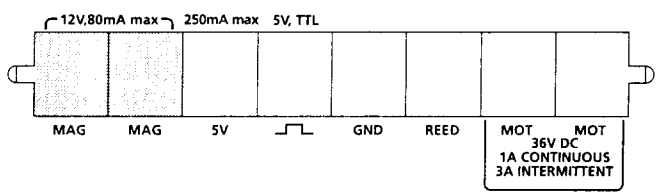


POLARISER CONNECTION

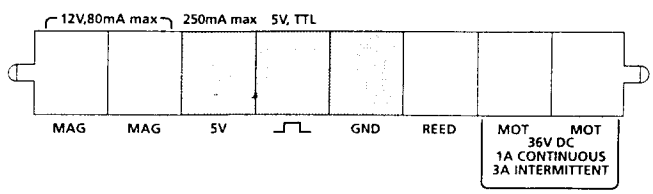
If the LNB on your dish antenna has an electromagnetic or mechanical polariser, connect it to the rear panel as shown. (Shaded areas indicate which connectors to use.)

NOTE: You can put two wires into one connector if you have both a polariser and an actuator connected.

Electromagnetic Polariser

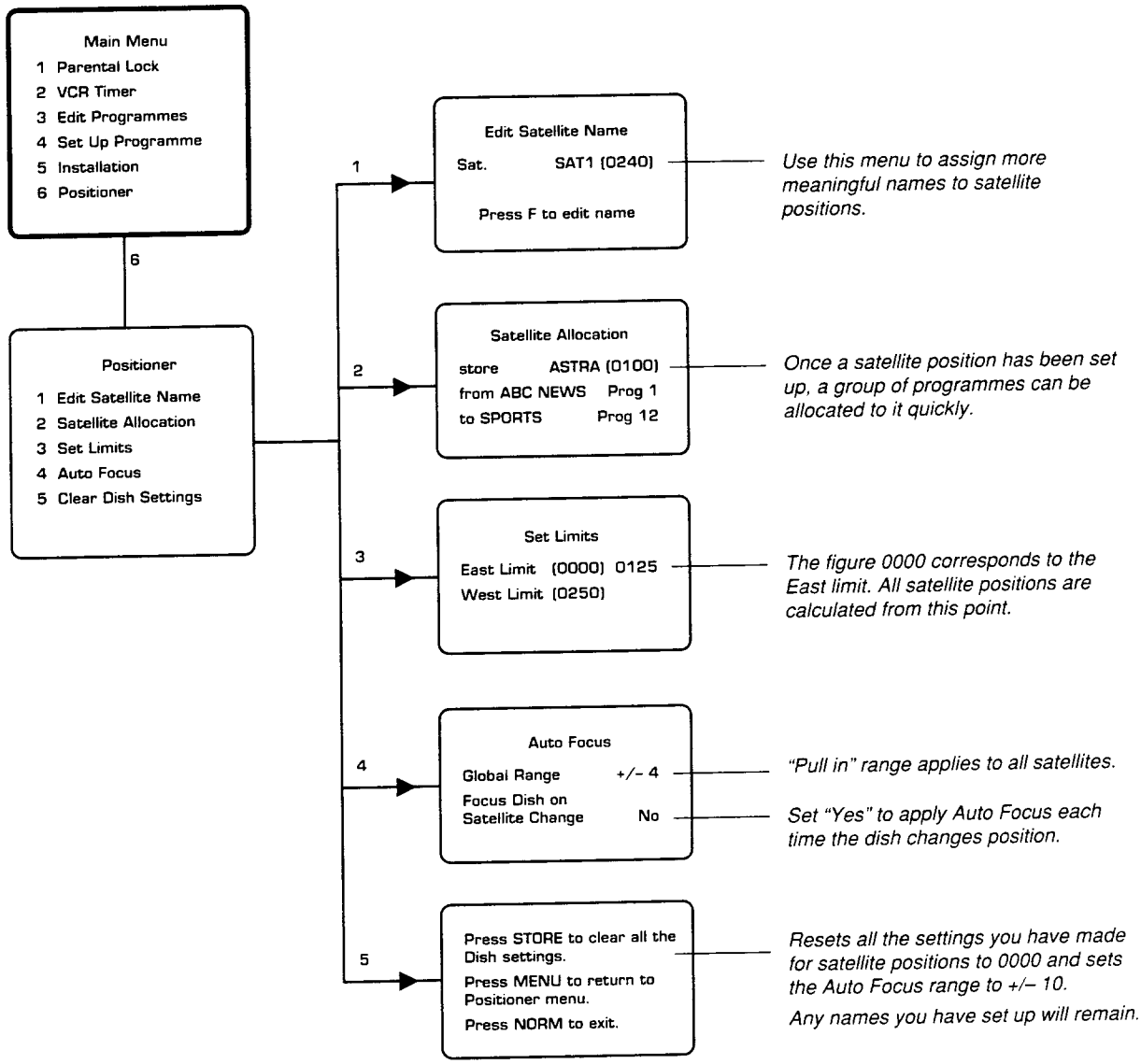


Mechanical Polariser



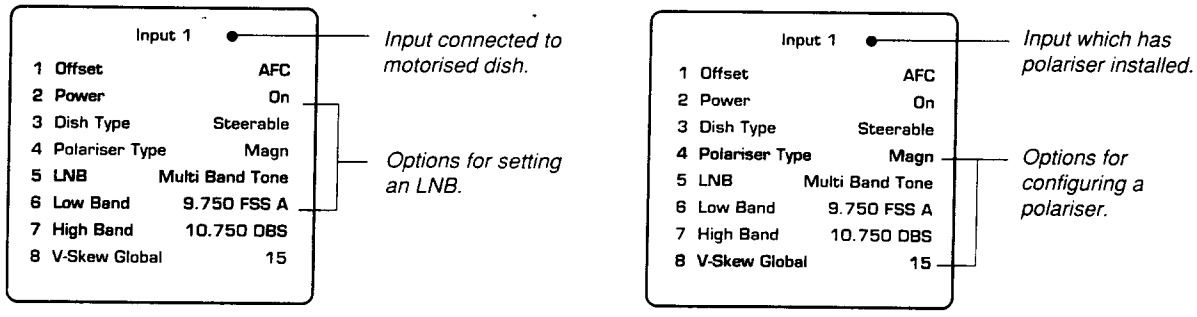
DISH POSITIONER MENU TREE

Dish positioner functions are accessed from the Main Menu, option 6.
Find your way around the menus in the normal way, using the ▲ and ▼ or the number keys.
Alter settings in the menus using the ◄ and ► keys or by direct numerical entry.
Press the STORE key to save any changes or the NORM key to exit menus without saving.


Main Menu
1 Parental Lock
2 VCR Timer
3 Edit Programmes
4 Set Up Programme
5 Installation
6 Positioner
6
Positioner
1 Edit Satellite Name
2 Satellite Allocation
3 Set Limits
4 Auto Focus
5 Clear Dish Settings
1
Edit Satellite Name
Sat. SAT1 (0240)
Press F to edit name
Use this menu to assign more meaningful names to satellite positions.
2
Satellite Allocation
store ASTRA (0100)
from ABC NEWS Prog 1
to SPORTS Prog 12
Once a satellite position has been set up, a group of programmes can be allocated to it quickly.
3
Set Limits
East Limit (0000) 0125
West Limit (0250)
The figure 0000 corresponds to the East limit. All satellite positions are calculated from this point.
4
Auto Focus
Global Range +/- 4
Focus Dish on Satellite Change No
"Pull in" range applies to all satellites.
Set "Yes" to apply Auto Focus each time the dish changes position.
5
Press STORE to clear all the Dish settings.
Press MENU to return to Positioner menu.
Press NORM to exit.
Resets all the settings you have made for satellite positions to 0000 and sets the Auto Focus range to +/– 10.
Any names you have set up will remain.

HOW TO CONFIGURE THE DISH POSITIONER FOR THE ATTACHED DISH ASSEMBLY

To use the positioner and allocate programmes correctly, you must configure the positioner for the dish assembly you are using. You do this at the Installation Menu (MENU, 5).


Input 1
1 Offset AFC
2 Power On
3 Dish Type Steerable
4 Polariser Type Magn
5 LNB Multi Band Tone
6 Low Band 9.750 FSS A
7 High Band 10.750 DBS
8 V-Skew Global 15
Input connected to motorised dish.
Options for setting an LNB.
Input 1
1 Offset AFC
2 Power On
3 Dish Type Steerable
4 Polariser Type Magn
5 LNB Multi Band Tone
6 Low Band 9.750 FSS A
7 High Band 10.750 DBS
8 V-Skew Global 15
Input which has polariser installed.
Options for configuring a polariser.

HOW TO MOVE THE DISH

Move the dish using the ► key to move East, and the ◄ key to move West. The dish only moves when the key is pressed down.

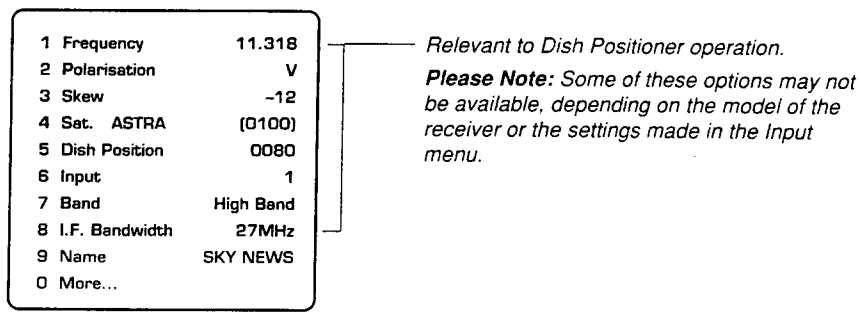
Note that the dish can only be moved if you are in the Set Up Programme or the Set Limits menus. Also the East and West limits must have been set for the dish antenna.

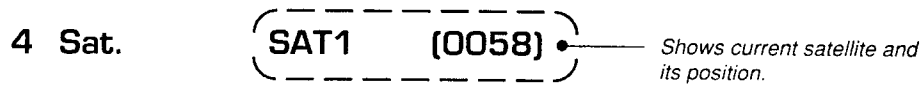
Direction of travel

IMPORTANT: You must establish the correct East/West movement before going on to use other features of the dish positioner. If the dish moves in the wrong direction then reverse the motor wires.

HOW TO SET UP PROGRAMMES

When setting up programmes using the Set Up Programme Menu , some extra menu options are provided to accomodate the additional features of the dish positioner.


1 Frequency 11.318
2 Polarisation V
3 Skew -12
4 Sat. ASTRA (0100)
5 Dish Position 0080
6 Input 1
7 Band High Band
8 I.F. Bandwidth 27MHz
9 Name SKY NEWS
0 More...
Relevant to Dish Positioner operation.
Please Note: Some of these options may not be available, depending on the model of the receiver or the settings made in the Input menu.



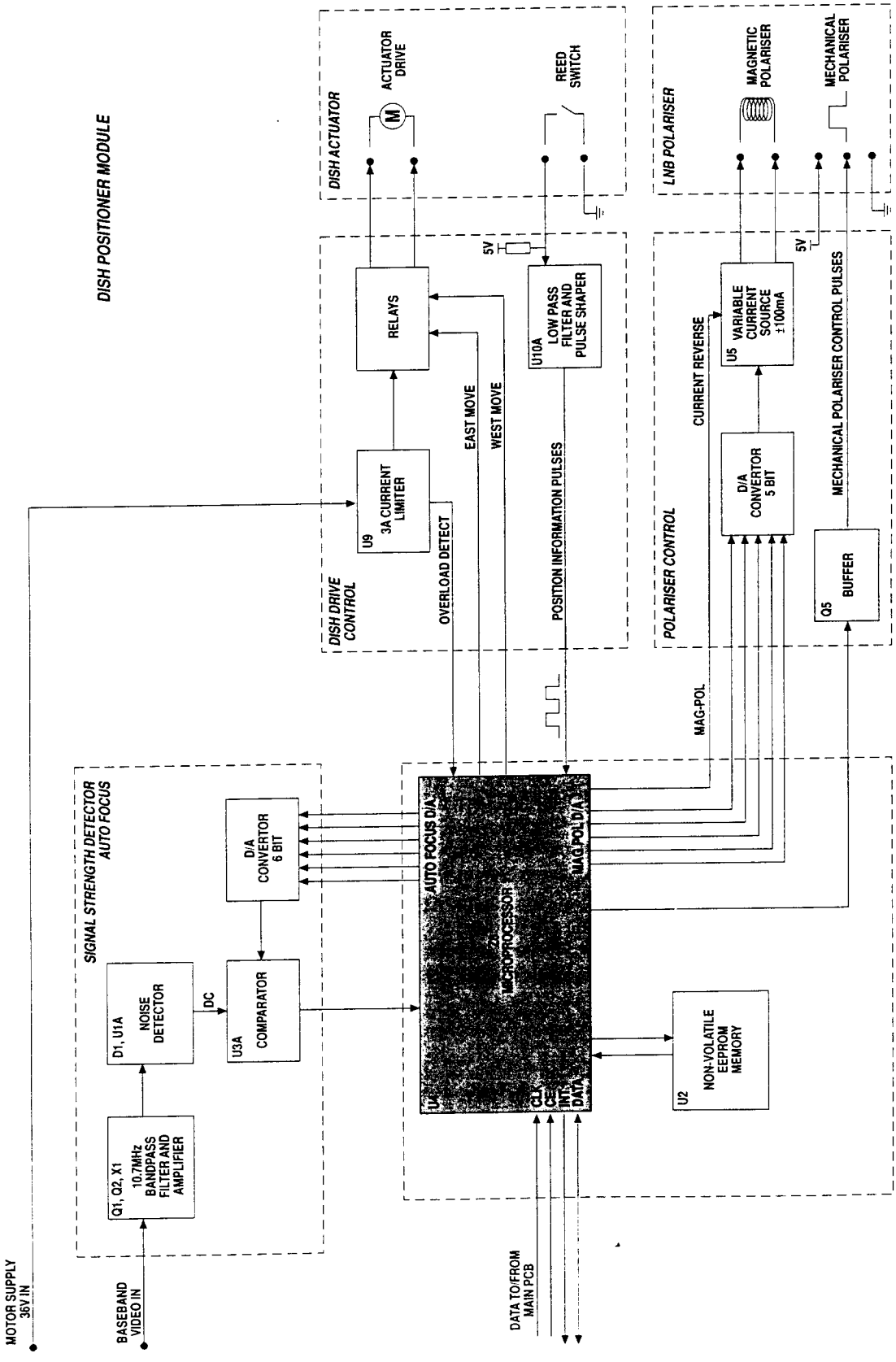
Moving the dish automatically

When viewing satellite programmes, press F then ◄ or ►. The dish will move automatically in the direction you have chosen. Press ◄ or ► again to change the direction of travel (the dish still moves automatically). Press any key to stop the dish.

CIRCUIT DESCRIPTION

General

The dish positioner module comprises a single circuit board which is factory fitted to the receiver as an option. The board controls all aspects of dish movement and polarisation. It interfaces with the main PCB via PL11 (12 way ribbon) for control and annunciation data and also takes motor power from the main PCB (via PL5). A functional block diagram is shown below.



REMOVING THE DISH POSITIONER MODULE FROM THE UNIT

With the cover removed from the satellite receiver:

Remove the 3 taptite screws from the 8 way push terminal on the rear panel of the receiver.

Crimp the stand-off prong at the front of the dish positioner board and remove the dish positioner board.

To remove the dish positioner board completely, disconnect the 12 way ribbon connector PL11 and the power connector PL5.

DISH MOVEMENT CONTROL

Microprocessor

All user commands for dish movement control are received from the IR handset and decoded within the receiver's microprocessor U22 on the main PCB. Dish control data is then re-transmitted via the 4 wire bi-direction serial bus up to the positioner's microprocessor U4. All information relating to dish positioner status is displayed by the receiver using the on-screen graphics system and/or the front panel display.

The dish positioner system is centered around a Z8 microprocessor U4. This utilises an on-chip clock oscillator for which the 12 MHz crystal X2 is used. The system control software is stored within ROM which is an integral part of U4. The microprocessor is active at all times, including standby mode. All the user definable variables (E/W limits, satellite names and positions, current dish position etc.) are stored in the non-volatile EEPROM memory IC U2. The microprocessor communicates directly with the EEPROM U2 via a bi-direction data bus (pins 2 and 14 of U4).

Eleven of the output ports are utilised to provide two separate D/A converters. The 6 bit D/A is used to provide a variable reference voltage for the auto-focus system. The 5 bit D/A provides a variable control voltage for the magnetic polariser current source IC U5. The mechanical polariser control pulses are generated by the microprocessor and output on pin 17.

Power

The dish actuator motor power is 28-38 V dc (nominally 36 V, but is load dependent). This is provided by D54 and C216 in the main PCB switched mode power supply area. The power enters the positioner PCB at PL2, and on to regulator IC U9 which is configured in current limit mode. This provides three very important functions: short circuit current foldback protection (<1 A); thermal overload shutdown (150°C); and fast current limiting (3 A).

The latter of these is most important, not only for overload protection, but also to prevent the motor start up current demand from exceeding 3 A each time the dish actuator is moved. Without the limiter, some larger motors would cause the receiver's SMPS circuit to shut down each time the motor was started. Q8, D10 and R66 form a sensing circuit to detect any of the overload shutdown conditions previously described. If the in/out differential on U9 exceeds approximately 6 V, then Q8 conducts thus pulling pin 12 of the microprocessor U4 high. If this overload condition persists, the relays will be switched off to remove the overload and an OSG warning message will appear at the TV. Transient overloads will occur each time the motor starts up, these are ignored by the software.

Motor relays and suppression

Diodes D8, D9, D11 and D12 protect the regulator against spikes, motor back-emf etc. The output of the regulator is switched by two SPDT relays to provide motor voltage reversal RL1 (west) and RL2 (east). When both relays are "off", the configuration of the contacts applies a direct short to the motor terminals in order to provide dynamic braking to the actuator motor. This minimises any over run when a dish movement ends.

All relays have some contact bounce which can cause large voltage fast transients whilst switching an inductive load. The amplitude of these transients is clipped by two diodes connected from each motor terminal to supply and ground (D17/D18 and D19/20). The snubber network R67 and C49 absorbs motor back emf and helps to minimise any arcing of the relay contacts. Capacitors C41, C42, C43, C44, C50, C51 and C56 provide RF filtering to all the dish connections on SK1.

Position feedback

The current dish position is monitored by counting the pulses sent by the pulse generator in the actuator unit (reed switch or photo interrupter types). The signal entering the positioner unit via SK1 pin 3 will often contain contact bounce and other unwanted transients. These are removed by the clipping diodes D15 , D16 and the low pass filter comprising R79 and C55. The resulting integrated signal is then squared off by IC U10A which is configured as a mid point biased comparator, thus providing a clean square wave signal to the count input of the microprocessor U4, via buffer Q9. Protection against accidental connection of 36 V motor power to the pulse input is provided by R79, D15 and D16.

Power fail protection

Should the mains power be lost whilst the dish is moving, the current position of the dish when it stops is not lost. This is achieved by the relatively slow discharge time of C35 which provides power to U2, U4 and U10 for around 2 seconds after the power fails. During this time, the actuator motor is stopped, and the dish position count is stored into the non-volatile EEPROM memory U2. When power is restored, normal operation of the positioner may resume.

AUTO FOCUS SYSTEM

This feature enables the positioner to automatically search within a pre set dish movement range, whilst simultaneously detecting the received signal strength. The position of strongest signal is memorised, so that after completion of the search, the dish can return to the peak signal position.

Signal strength detector

Signal strength measurement is not obtained by detecting the satellite RF signal, instead, the out-of-band noise present in the tuner baseband video signal is used. This noise is a product of the LNB and tuner/demodulator system, and its amplitude is large when the satellite signal is weak and vice versa. This system also provides information to enable the signal bargraph displays used within the OSG menus and on the receiver front panel.

The tuner baseband output arrives at PL1, is amplified by gain stages Q1 and Q2. A 10.7 MHz ceramic bandpass filter X1 forms the coupling between the two gain stages, and this removes the unwanted video signal and the audio subcarriers leaving behind a noise envelope approximately 150 kHz wide centred on 10.7 MHz. Diode D1 and IC U1A form a temperature compensated RF amplitude detector. A voltage which is directly proportional to the strength of the received signal appears at U1A pin 1.

This signal voltage is processed by a 6 bit successive approximation A/D converter consisting of U3A and the microprocessor U4. The signal voltage is compared by U3A comparator with the output of software driven D/A converter (microprocessor pins 4, 5, 19, 20, 21, 23). Whilst the AF system, or the signal bargraph is active, the D/A output is constantly ramped up and down by the software. The output of U3A (pin 1) goes to microprocessor input (pin 1). This line will toggle when the D/A ramp level is equal to the detected signal voltage and this enables the software to detect the received signal strength from the satellite dish.

POLARISER CONTROL

Mechanical polariser

Either electromagnetic or mechanical polarisers may be used. For the mechanical servo type of polariser, a variable width pulse signal is generated directly by software within the microprocessor U4. The range is 0.8 ms to 2.2 ms depending upon the polarity skew value set up within the menu system of the receiver. These pulses are then buffered by Q5 before reaching the pulse output connector SK1 pin 5.

A power source with short circuit protection for the polariser servo is provided by U8 5 V regulator IC. R58, C39, R60 and D5 provide protection to the circuit should 36 V motor power be accidentally applied to the polariser output terminals due to incorrect motor wire connection.

Electromagnetic polariser

U5 provides a variable current source up to ±100 mA to energise an electromagnetic polariser coil. The polarity of the energising current is set by the microprocessor via U5 pin 5 and pin 6. When pin 15 of the microprocessor toggles from 0 to 5 V, the current output of U5 is reversed.

The magnitude of the energising current is controlled by the output voltage of comparator U1B. The energising current returns to ground from pin 1 of U5 via R55. The voltage developed across this resistor is thus directly proportional to the current taken by the polariser coil. This voltage is compared with the control voltage provided by the software driven D/A converter (microprocessor pins 24-28). A constant current loop is thus produced, with the current value set by variables in the receiver OSG menu system.

Short circuit protection for the magnetic polariser output is provided by the 12 V/100 mA voltage regulator IC U6. In the event of either output terminal being shorted to ground, the regulator will limit the current to a safe value.

NOTE: Should the 36 volt actuator motor be accidentally connected between one of the motor terminals and one of the magnetic polariser terminals, damage is likely to occur when a dish move command is given. The design of this product cannot protect for this and care should be taken to prevent this occurrence.

ERROR MESSAGES

Under certain conditions, a message may be displayed on screen indicating that an abnormal or unusual situation has arisen. These messages are explained here along below with suggested causes and remedies as appropriate:

LIMITS NOT SET

Before the dish positioner can be used to move the dish, the software limits must be defined and stored from within the Set Limits menu. If any attempt to move the dish is made from any other menu or operating mode before the limits have been defined this message will be displayed and dish movement will be prevented.

DISH AT LIMITS

This message is displayed whenever an attempt is made to move the dish beyond the position at which the East or West software limits have been set. The dish cannot be moved any further in that direction. It can however be moved in the opposite direction, away from the software limit position. In order to adjust the dish movement range, the software limits may be moved at any time by entering the Set Limits menu. Any previously stored satellite positions will automatically be recalculated if the limits are redefined.

POSITION OUTSIDE LIMITS

This message occurs if a programme is selected which has been allocated to a satellite position which is not within the range defined by the East and West software limits. The dish will not move from the present position and the message will be displayed. This situation can only occur if the user has re-defined one or both of the software limits in such a way that a previously stored satellite position is now outside the East/West limit range. The situation is corrected by resetting the software limit.

POSITION NOT SET

This message occurs whenever a programme is selected which is allocated to a satellite name which has not been set to a specific dish position. The position may easily be set from within the Set-up Programme menu, (see user guide for more information).

MOTOR ERROR

This message will occur whenever a dish move command is issued by the dish positioner, but for some reason no pulses are received back into the positioner reed input terminal. The possible causes of this condition are listed here:

a) An attempt is made to move the dish beyond the hardware limit switch settings. Most types of actuator units have adjustable micro-switches for over-travel protection. The software East/West limits should be set within the range of the actuator hardware limit switches in order to prevent this message from appearing.

b) An attempt is made to move the dish whilst the actuator motor circuit is disconnected. e.g. A motor wire may have become disconnected from the rear panel terminal, or at the dish end of the control cable.

c) An attempt is made to move the dish whilst the pulse feedback reed circuit is inoperative. e.g. the reed switch wire may have become disconnected on the rear panel or at the dish end of the control cable. Alternatively, the reed switch itself may be damaged thus causing no feedback pulses to be transmitted back to the dish positioner.

NOTE: *Any of the fault conditions described in c) will result in the dish being moved without the current position count register being updated, thus any previously stored satellite positions will appear to be incorrect. after the original fault has been rectified. The current position may be restored by following the recovery procedure on page 11.*

ERROR MESSAGES (CONT.)

MOTOR OVERLOAD

This message will occur if the 36 V dish actuator supply is overloaded or overheated. Once this message has appeared, the relays will be switched off immediately to remove the overload condition. Some possible causes of the overload condition occurring are described here:

a) An attempt is made to move the dish whilst a direct short is present across the motor output terminals. Also, if the actuator motor is stalled or seized, a virtual short will be present across the output terminals.

b) If the actuator motor power supply circuit becomes overheated, it will go into thermal shutdown mode which will cause the motor overload message to appear. Some possible reasons for this are:

i) Use of a very large actuator motor which may take too much current from the dish positioner;

ii) Restriction of the ventilation slots on the top or the base of the receiver;

iii) Repetitive stop/start moving of the dish for an extended period of time causing the regulator to heat up, because the motor will not reach its normal rotational speed and therefore will draw an abnormally high current, thus heating the current regulator.

Any of the above, or a combination, may well be the cause of the problem. Once the receiver has been allowed to cool for a short while, normal operation can be resumed. However, the cause of the overheating should be identified and corrected.

RECOVERY PROCEDURE

If for any reason the current displayed satellite position counter should become out of step with the actual satellite position, follow this procedure to restore the position counter information:

1. Press MENU, then 4 to display the Set Up Programme menu.
2. Select a satellite that you have previously stored and adjust for best picture using ◄ and ► keys.
3. Press the F key twice to enable Auto Focus to lock in to the strongest signal from this satellite.
4. Press F then STORE. The position that you had previously stored for this satellite is loaded into the current position counter, you should now be able to find all other preset satellites in the normal way.

GRID REFERENCES - CIRCUIT DIAGRAM

CAPACITORS	
C1	D6
C2	D6
C3	D6
C4	D6
C5	D5
C6	D5
C7	D5
C8	D5
C9	D5
C10	D5
C11	D5
C12*	D4
C13	D4
C14	D5
C15	C5
C16	C5
C17	C5
C18	C5
C19	B5
C20	B5
C21	B5
C22	B5
C23	B5
C24	A6
C25	B6
C26	B5
C27	A5
C28	C3
C29	C3
C30*	C3
C31	C3
C32	D3
C33	D3
C34	D2
C35	D2
C36	D2
C37	C4
C38	C2
C39	C2
C40	C2
C41	C2
C42	C1
C43	C1
C44	C1
C45	B4
C46	B4
C47	B3
C48	B2
C49	B1
C50	B1
C51	B1
C52	A3
C53	A4
C54	A3
C55	A3
C56	B1

DIODES	
D1	D5
D2	B6
D3	B6
D4	D2
D5	C2
D6	B4
D7	B3
D8	B3
D9	B2
D10	B2
D11	B2
D12	B2
D13	B3
D14	A3
D15	A3
D16	A2
D17	B2
D18	B1
D19	B1
D20	B2

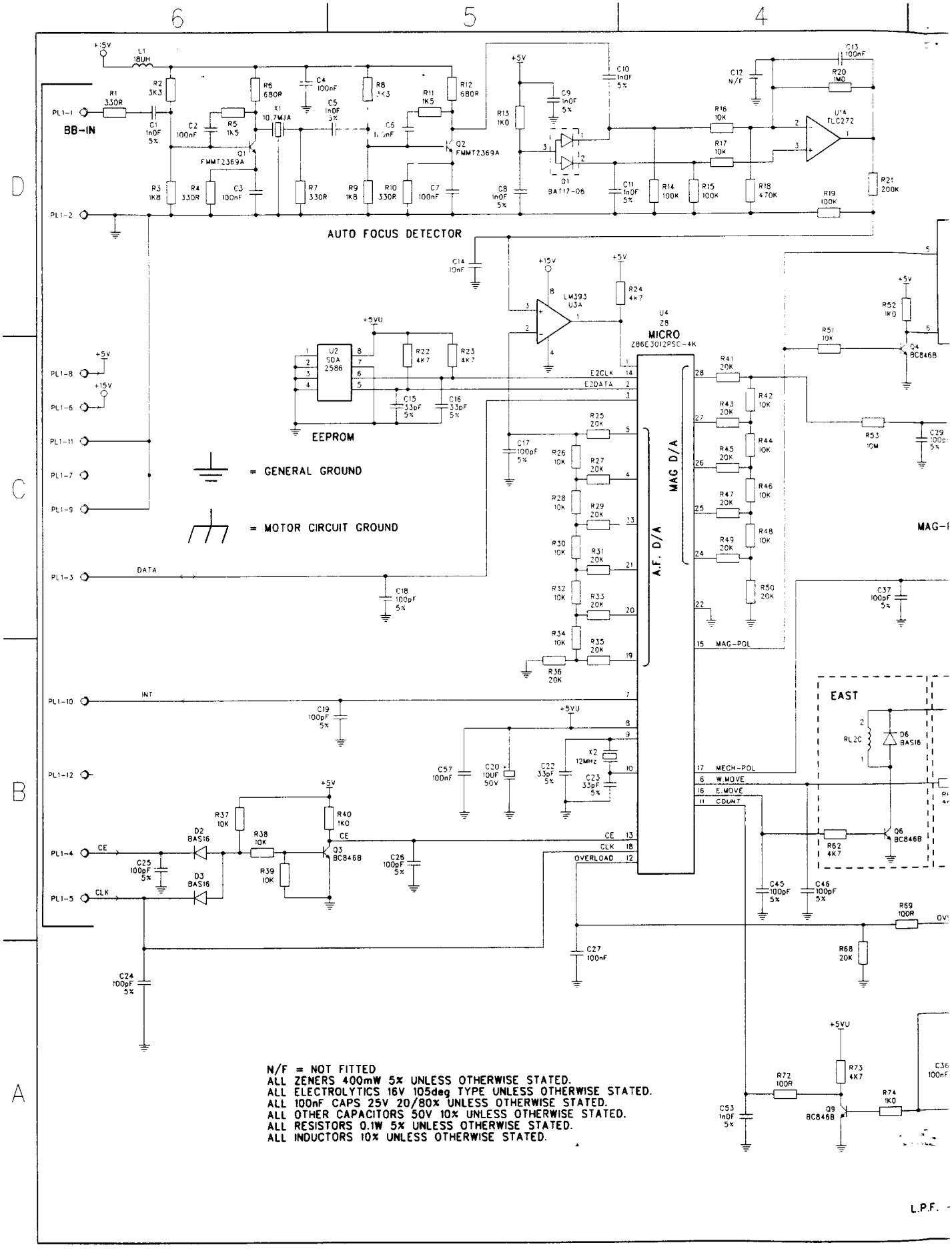
TRANSISTORS	
Q1	D6
Q2	D5
Q3	B6
Q4	C4
Q5	C2
Q6	B4
Q7	B3
Q8	B3
Q9	A4

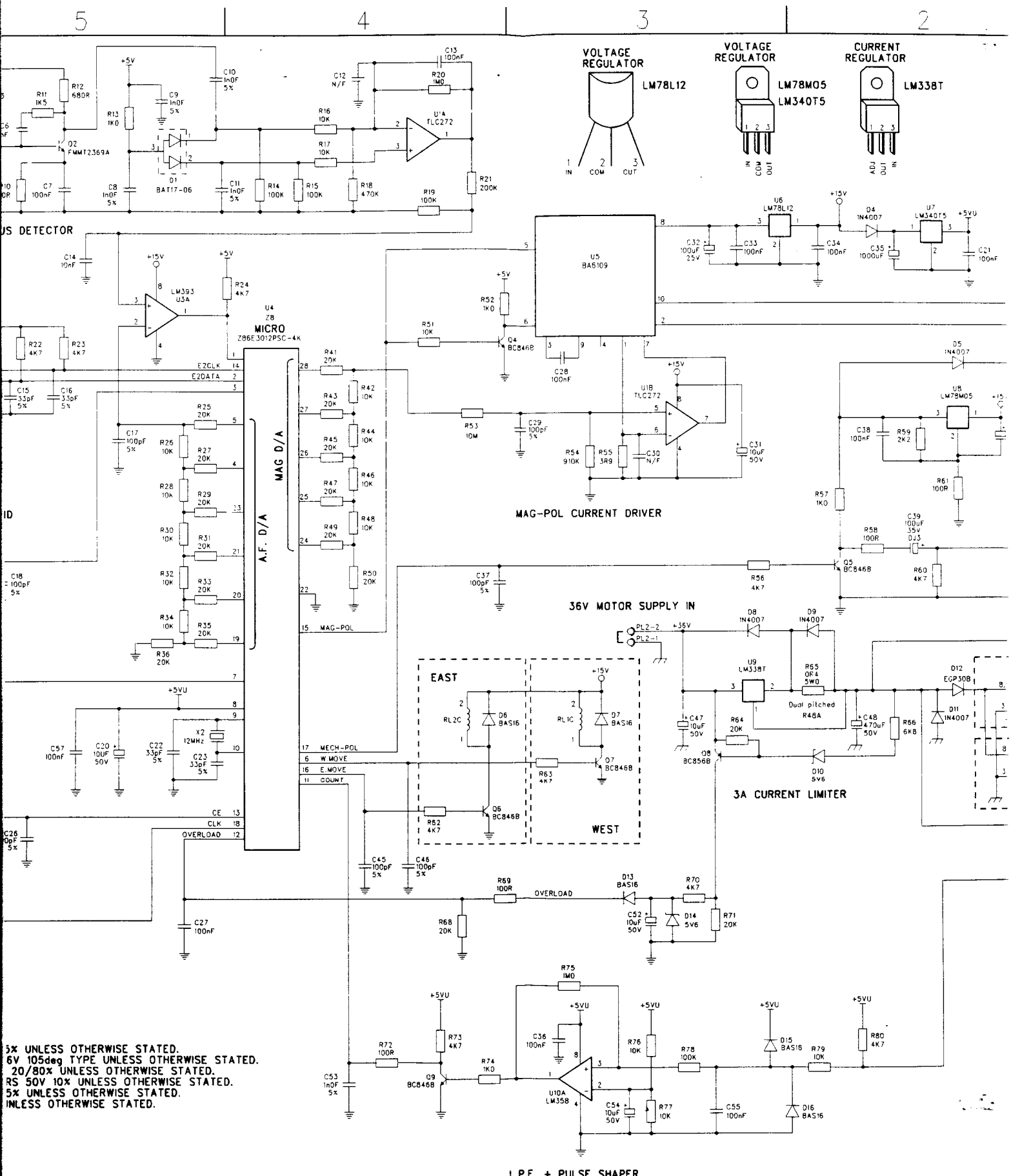
RESISTORS	
R1	D6
R2	D6
R3	D6
R4	D6
R5	D6
R6	D6
R7	D6
R8	D5
R9	D5
R10	D5
R11	D5
R12	D5
R13	D5
R14	D4
R15	D4
R16	D4
R17	D4
R18	D4
R19	D4
R20	D4
R21	D4
R22	C5
R23	C5
R24	D4
R25	C5
R26	C5
R27	C5
R28	C5
R29	C5
R30	C5
R31	C5
R32	C5
R33	C5
R34	C5
R35	B5
R36	B5
R37	B6
R38	B6
R39	B6
R40	B6
R41	C4
R42	C4
R43	C4
R44	C4
R45	C4
R46	C4
R47	C4
R48	C4
R49	C4
R50	C4
R51	C4
R52	D4
R53	C4
R54	C3
R55	C3
R56	C3
R57	C2
R58	C2
R59	C2
R60	C2
R61	C2
R62	B4
R63	B3
R64	B3
R65	B2
R66	B2
R67	B1
R68	A4
R69	B3
R70	B3
R71	A3
R72	A4
R73	A4
R74	A4
R75	A3
R76	A3
R77	A3
R78	A3
R79	A2
R80	A2

ICS	
U1A	D4
U1B	C3
U2	C5
U3A	D5
U4	C4
U5	D3
U6	D3
U7	D2
U8	C2
U9	B3
U10A	A3

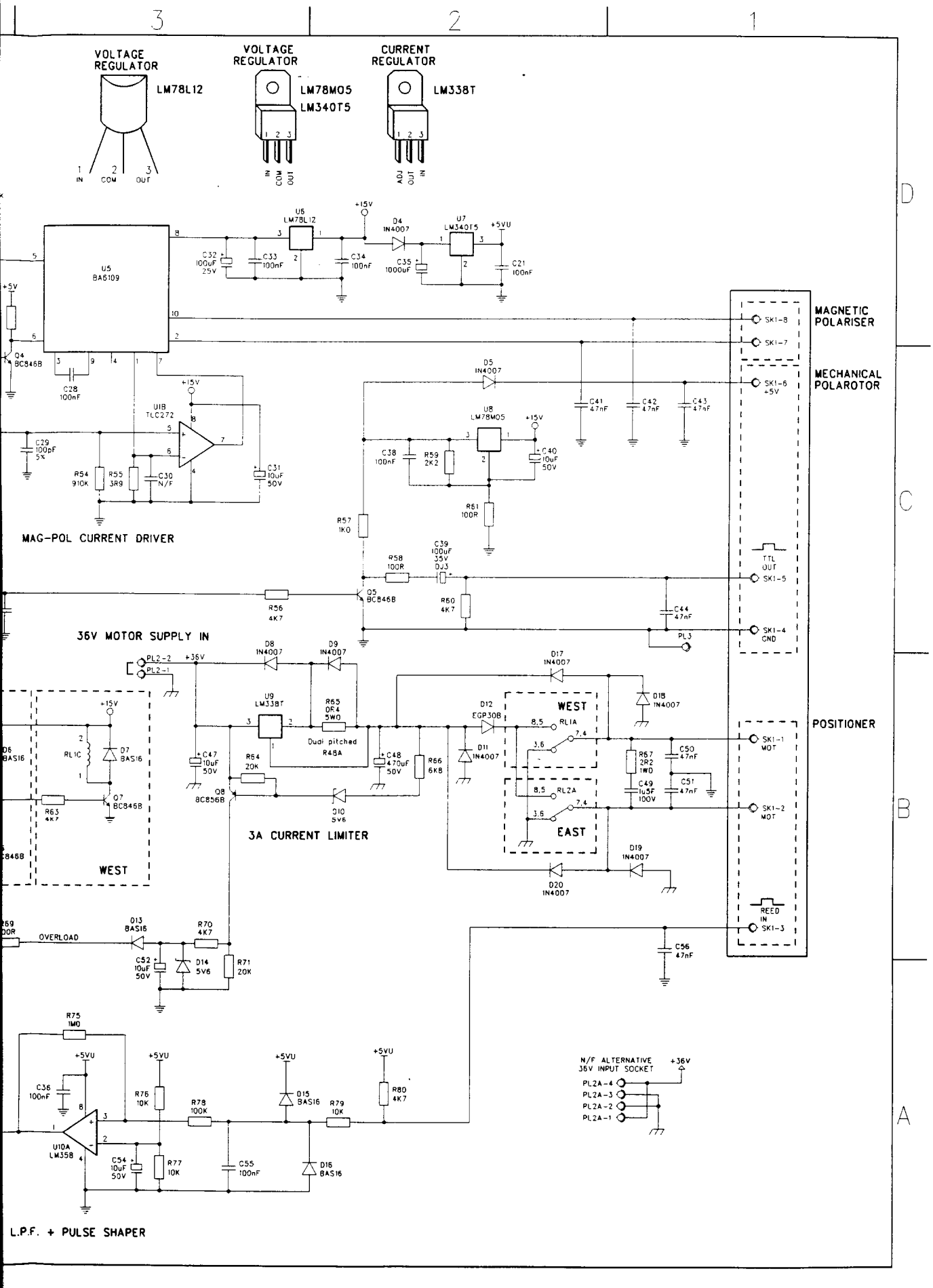
MISCELLANEOUS	
L1	D6
RL1A	B2
RL1C	B3
RL2A	B2
RL2C	B4
X1	D6
X2	B5

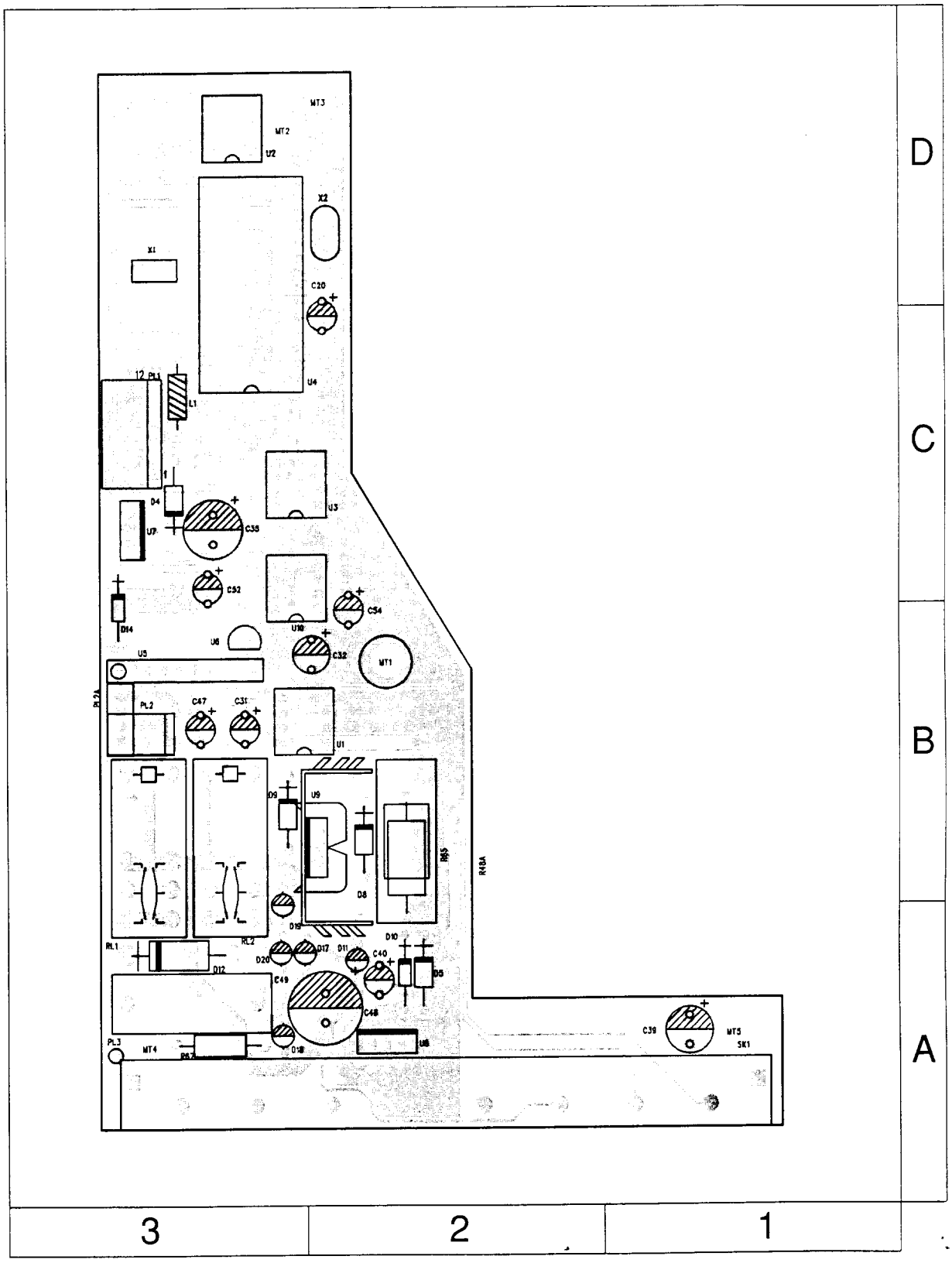
* = NOT FITTED


6
5
4
D
C
B
A
BB-IN
AUTO FOCUS DETECTOR
EEPROM
MICRO
Z86E3012PSC-4K
MAG D/A
A.F. D/A
= GENERAL GROUND
= MOTOR CIRCUIT GROUND
EAST
N/F = NOT FITTED
ALL ZENERS 400mW 5% UNLESS OTHERWISE STATED.
ALL ELECTROLYTICS 16V 105deg TYPE UNLESS OTHERWISE STATED.
ALL 100nF CAPS 25V 20/80% UNLESS OTHERWISE STATED.
ALL OTHER CAPACITORS 50V 10% UNLESS OTHERWISE STATED.
ALL RESISTORS 0.1W 5% UNLESS OTHERWISE STATED.
ALL INDUCTORS 10% UNLESS OTHERWISE STATED.


5
4
3
2
VOLTAGE REGULATOR
LM78L12
VOLTAGE REGULATOR
LM78M05
LM340T5
CURRENT REGULATOR
LM338T
IN COM OUT
ADJ OUT IN
US DETECTOR
MICRO
Z86E3012PSC-4K
A.F. D/A
MAG D/A
MAG-POL CURRENT DRIVER
36V MOTOR SUPPLY IN
3A CURRENT LIMITER
EAST
WEST
Dual pitched
R48A
OVERLOAD
L.P.F. + PULSE SHAPER
5% UNLESS OTHERWISE STATED.
6V 105deg TYPE UNLESS OTHERWISE STATED.
20/80% UNLESS OTHERWISE STATED.
RS 50V 10% UNLESS OTHERWISE STATED.
5% UNLESS OTHERWISE STATED.
INLESS OTHERWISE STATED.

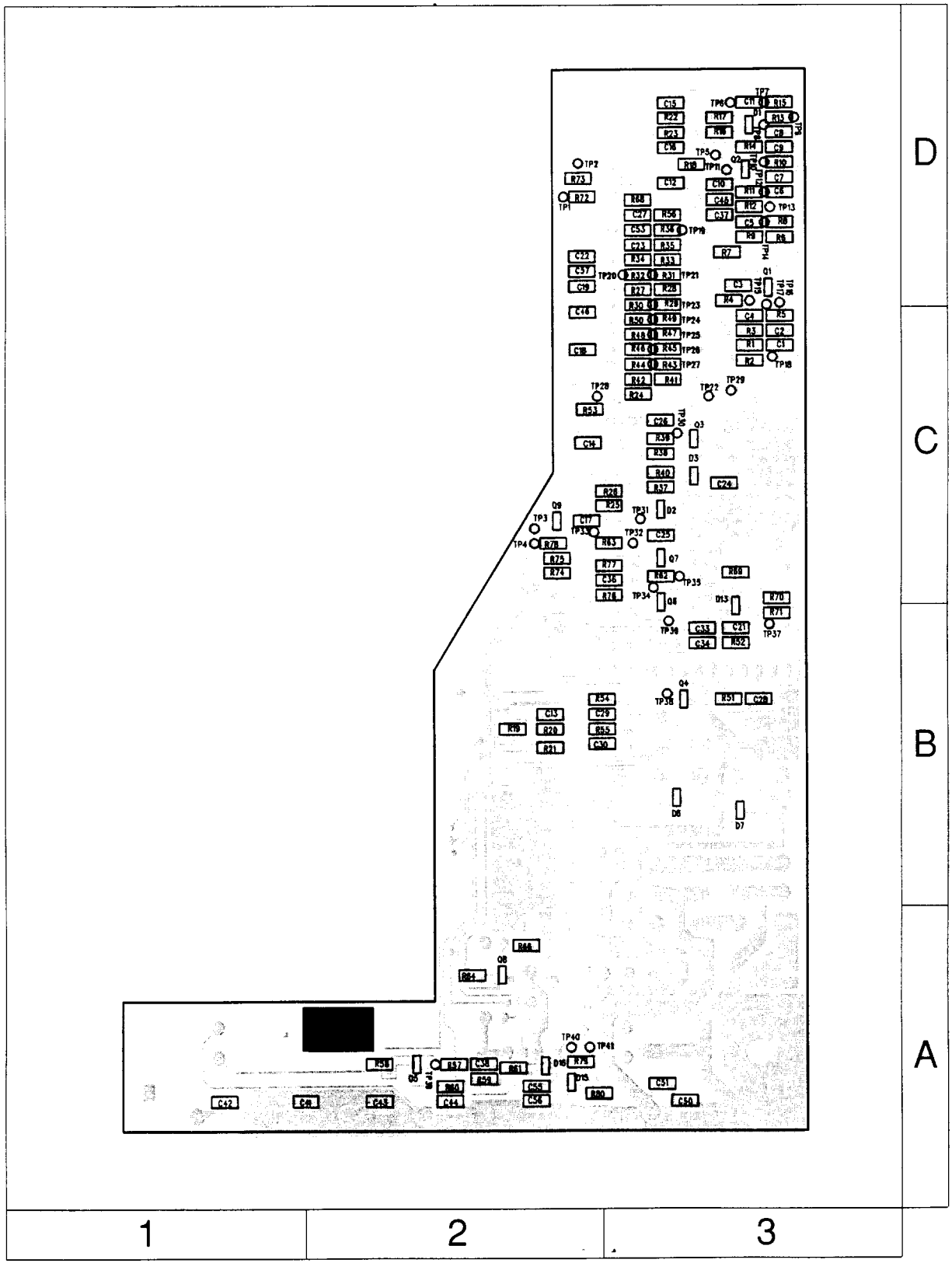
DISH POSITIONER MODULE CIRCUIT DIAGRAM





COMPONENT SIDE

PCB LAYOUT DIAGRAMS



SURFACE MOUNT SIDE

GRID REFERENCES - PRINTED CIRCUIT BOARD

CAPACITORS	
C1†	C3
C2†	C3
C3†	D3
C4†	C3
C5†	D3
C6†	D3
C7†	D3
C8†	D3
C9†	D3
C10†	D3
C11†	D3
C12†*	D3
C13†	B2
C14†	C2
C15†	D3
C16†	D3
C17†	C2
C18†	C2
C19†	D2
C20	D2
C21†	B3
C22†	D2
C23†	D3
C24†	C3
C25†	C3
C26†	C3
C27†	D3
C28†	B3
C29†	B3
C30†	B3
C31	B3
C32	B2
C33†	B3
C34†	B3
C35	C3
C36†	C3
C37†	D3
C38†	A2
C39	A1
C40	A2
C41†	A1
C42†	A1
C43†	A2
C44†	A2
C45†	D3
C46†	D2
C47	B3
C48	A2
C49	A2
C50†	A3
C51†	A3
C52	C3
C53†	D3
C54	C2
C55†	A2
C56†	A2

DIODES	
D1†	D3
D2†	C3
D3†	C3
D4	C3
D5	A2
D6†	B3
D7†	B3
D8	B2
D9	B3
D10	A2
D11	A3
D12	A3
D13†	C3
D14	C3
D15†	A2
D16†	A2
D17	A3
D18	A3
D19	A3
D20	A3

TRANSISTORS	
Q1†	D3
Q2†	D3
Q3†	C3
Q4†	B3
Q5†	A2
Q6†	C3
Q7†	C3
Q8†	A2
Q9†	C2

RESISTORS	
R1†	C3
R2†	C3
R3†	C3
R4†	D3
R5†	C3
R6†	D3
R7†	D3
R8†	D3
R9†	D3
R10†	D3
R11†	D3
R12†	D3
R13†	D3
R14†	D3
R15†	D3
R16†	D3
R17†	D3
R18†	D3
R19†	B2
R20†	B2
R21†	B2
R22†	D3
R23†	D3
R24†	C3
R25†	C3
R26†	C3
R27†	D3
R28†	D3
R29†	D3
R30†	D3
R31†	D3
R32†	D3
R33†	D3
R34†	D3
R35†	D3
R36†	D3
R37†	C3
R38†	C3
R39†	C3
R40†	C3
R41†	C3
R42†	C3
R43†	C3
R44†	C3
R45†	C3
R46†	C3
R47†	C3
R48†	C3
R49†	C3
R50†	C3
R51†	B3
R52†	B3
R53†	C2
R54†	B3
R55†	B3
R56†	D3
R57†	A2
R58†	A2
R59†	A2
R60†	A2
R61†	A2
R62†	C3
R63†	C3
R64†	A2
R65	B2
R66†	A2
R67	A3
R68†	D3
R69†	C3
R70†	C3
R71†	B3
R72†	D2
R73†	D2
R74†	C2
R75†	C2
R76†	C3
R77†	C3
R78†	C2
R79†	A3
R80†	A3

ICS	
U1	B3
U2	D3
U3	C3
U4	D3
U5	B3
U6	B3
U7	C3
U8	A2
U9	B2
U10	C3

MISCELLANEOUS	
L1	C3
PL1	C3
PL2	B3
PL3	A3
RL1	B3
RL2	B3
SK1	A1
X1	D3
X2	D2

* = NOT FITTED

† = SURFACE MOUNTED COMPONENT

SPARE PARTS LIST

Capacitors

C1	SMD 1NF 50V 5% CER COG CAP 0805 (TRS)	950-1025501
C2	SMD 0.1UF 25V 20/80% CER Y5V CAP 0805 TR	950-1042951
C3	SMD 0.1UF 25V 20/80% CER Y5V CAP 0805 TR	950-1042951
C4	SMD 0.1UF 25V 20/80% CER Y5V CAP 0805 TR	950-1042951
C5	SMD 1NF 50V 5% CER COG CAP 0805 (TRS)	950-1025501
C6	SMD 0.1UF 25V 20/80% CER Y5V CAP 0805 TR	950-1042951
C7	SMD 0.1UF 25V 20/80% CER Y5V CAP 0805 TR	950-1042951
C8	SMD 1NF 50V 5% CER COG CAP 0805 (TRS)	950-1025501
C9	SMD 1NF 50V 5% CER COG CAP 0805 (TRS)	950-1025501
C10	SMD 1NF 50V 5% CER COG CAP 0805 (TRS)	950-1025501
C11	SMD 1NF 50V 5% CER COG CAP 0805 (TRS)	950-1025501
C13	SMD 0.1UF 25V 20/80% CER Y5V CAP 0805 TR	950-1042951
C14	SMD 10NF 50V 10% CER X7R CAP 0805 (TRS)	950-1035621
C15	SMD 33PF 50V 5% CER COG CAP 0805 (TRS)	950-3305501
C16	SMD 33PF 50V 5% CER COG CAP 0805 (TRS)	950-3305501
C17	SMD 100PF 50V 5% CER COG CAP 0805 (TRS)	950-1015501
C18	SMD 100PF 50V 5% CER COG CAP 0805 (TRS)	950-1015501
C19	SMD 100PF 50V 5% CER COG CAP 0805 (TRS)	950-1015501
C20	10UF 50V 20% 105DEG RADIAL ELECT' CAP TR	855-1065751
C21	SMD 0.1UF 25V 20/80% CER Y5V CAP 0805 TR	950-1042951
C22	SMD 33PF 50V 5% CER COG CAP 0805 (TRS)	950-3305501
C23	SMD 33PF 50V 5% CER COG CAP 0805 (TRS)	950-3305501
C24	SMD 100PF 50V 5% CER COG CAP 0805 (TRS)	950-1015501
C25	SMD 100PF 50V 5% CER COG CAP 0805 (TRS)	950-1015501
C26	SMD 100PF 50V 5% CER COG CAP 0805 (TRS)	950-1015501
C27	SMD 0.1UF 25V 20/80% CER Y5V CAP 0805 TR	950-1042951
C28	SMD 0.1UF 25V 20/80% CER Y5V CAP 0805 TR	950-1042951
C29	SMD 100PF 50V 5% CER COG CAP 0805 (TRS)	950-1015501
C31	10UF 50V 20% 105DEG RADIAL ELECT' CAP TR	855-1065751
C32	100UF 25V 20% 105DEG RADIAL ELECT CAP TR	855-1072751
C33	SMD 0.1UF 25V 20/80% CER Y5V CAP 0805 TR	950-1042951
C34	SMD 0.1UF 25V 20/80% CER Y5V CAP 0805 TR	950-1042951
C35	1000UF 16V RADIAL ELECT' CAP TR	855-1081951
C36	SMD 0.1UF 25V 20/80% CER Y5V CAP 0805 TR	950-1042951
C37	SMD 100PF 50V 5% CER COG CAP 0805 (TRS)	950-1015501
C38	SMD 0.1UF 25V 20/80% CER Y5V CAP 0805 TR	950-1042951
C39	100UF 35V RADIAL ELECT' CAP TR	855-1073951
C40	10UF 50V 20% 105DEG RADIAL ELECT' CAP TR	855-1065751
C41	SMD 47NF 50V 10% CER X7R CAP 0805 (TRS)	950-4735621
C42	SMD 47NF 50V 10% CER X7R CAP 0805 (TRS)	950-4735621
C43	SMD 47NF 50V 10% CER X7R CAP 0805 (TRS)	950-4735621
C44	SMD 47NF 50V 10% CER X7R CAP 0805 (TRS)	950-4735621
C45	SMD 100PF 50V 5% CER COG CAP 0805 (TRS)	950-1015501
C46	SMD 100PF 50V 5% CER COG CAP 0805 (TRS)	950-1015501
C47	10UF 50V 20% 105DEG RADIAL ELECT' CAP TR	855-1065751
C48	470UF 50V 105 DEG RADIAL ELECT CAP	855-4775950
C49	1U5 100V 22.5MM BOX POLYESTER CAP	152-1527690
C50	SMD 47NF 50V 10% CER X7R CAP 0805 (TRS)	950-4735621
C51	SMD 47NF 50V 10% CER X7R CAP 0805 (TRS)	950-4735621
C52	10UF 50V 20% 105DEG RADIAL ELECT' CAP TR	855-1065751
C53	SMD 1NF 50V 5% CER COG CAP 0805 (TRS)	950-1025501
C54	10UF 50V 20% 105DEG RADIAL ELECT' CAP TR	855-1065751
C55	SMD 0.1UF 25V 20/80% CER Y5V CAP 0805 TR	950-1042951
C56	SMD 47NF 50V 10% CER X7R CAP 0805 (TRS)	950-4735621

Diodes

D1	SMD DUAL DIODE-BAT17-06 C ANODE SOT23 TR	912-0601751
D2	SMD DIODE-BAS16/DAN212KT146 SOT-23	912-0001651
D3	SMD DIODE-BAS16/DAN212KT146 SOT-23	912-0001651
D4	DIODE-1N4007 TR	120-0400701
D5	DIODE-1N4007 TR	120-0400701
D6	SMD DIODE-BAS16/DAN212KT146 SOT-23	912-0001651
D7	SMD DIODE-BAS16/DAN212KT146 SOT-23	912-0001651
D8	DIODE-1N4007 TR	120-0400701
D9	DIODE-1N4007 TR	120-0400701
D10	5V6 5% 400MW ZENER DIODE TR	125-0056501
D11	DIODE-1N4007 TR	120-0400701
D12	DIODE - EGP30B TR	120-1003001
D13	SMD DIODE-BAS16/DAN212KT146 SOT-23	912-0001651
D14	5V6 5% 400MW ZENER DIODE TR	125-0056501
D15	SMD DIODE-BAS16/DAN212KT146 SOT-23	912-0001651
D16	SMD DIODE-BAS16/DAN212KT146 SOT-23	912-0001651
D17	DIODE-1N4007 TR	120-0400701
D18	DIODE-1N4007 TR	120-0400701
D19	DIODE-1N4007 TR	120-0400701
D20	DIODE-1N4007 TR	120-0400701

Transistors

Q1	SMD TRANSISTOR-FMMT2369A SOT-23	911-0236951
Q2	SMD TRANSISTOR-FMMT2369A SOT-23	911-0236951
Q3	SMD TRANSISTOR-BC846B SOT-23	911-1084651
Q4	SMD TRANSISTOR-BC846B SOT-23	911-1084651
Q5	SMD TRANSISTOR-BC846B SOT-23	911-1084651
Q6	SMD TRANSISTOR-BC846B SOT-23	911-1084651
Q7	SMD TRANSISTOR-BC846B SOT-23	911-1084651
Q8	SMD TRANSISTOR-BC856B SOT-23	911-1085651
Q9	SMD TRANSISTOR-BC846B SOT-23	911-1084651

Resistors

R1	SMD 330R 0.1W 5% RES 0805 (TRS)	940-3310501
R2	SMD 3K3 0.1W 5% RES 0805 (TRS)	940-3320501
R3	SMD 1K8 0.1W 5% RES 0805 (TRS)	940-1820501
R4	SMD 330R 0.1W 5% RES 0805 (TRS)	940-3310501
R5	SMD 1K5 0.1W 5% RES 0805 (TRS)	940-1520501
R6	SMD 680R 0.1W 5% RES 0805 (TRS)	940-6810501
R7	SMD 330R 0.1W 5% RES 0805 (TRS)	940-3310501
R8	SMD 3K3 0.1W 5% RES 0805 (TRS)	940-3320501
R9	SMD 1K8 0.1W 5% RES 0805 (TRS)	940-1820501
R10	SMD 330R 0.1W 5% RES 0805 (TRS)	940-3310501
R11	SMD 1K5 0.1W 5% RES 0805 (TRS)	940-1520501
R12	SMD 680R 0.1W 5% RES 0805 (TRS)	940-6810501
R13	SMD 1K 0.1W 5% RES 0805 (TRS)	940-1020501
R14	SMD 100K 0.1W 5% RES 0805 (TRS)	940-1040501
R15	SMD 100K 0.1W 5% RES 0805 (TRS)	940-1040501
R16	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R17	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R18	SMD 470K 0.1W 5% RES 0805 (TRS)	940-4740501
R19	SMD 100K 0.1W 5% RES 0805 (TRS)	940-1040501
R20	SMD 1M 0.1W 5% RES 0805 (TRS)	940-1050501
R21	SMD 200K 0.1W 5% RES 0805 (TRS)	940-2040501
R22	SMD 4K7 0.1W 5% RES 0805 (TRS)	940-4720501
R23	SMD 4K7 0.1W 5% RES 0805 (TRS)	940-4720501
R24	SMD 4K7 0.1W 5% RES 0805 (TRS)	940-4720501
R25	SMD 20K 0.1W 5% RES 0805 (TRS)	940-2030501
R26	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R27	SMD 20K 0.1W 5% RES 0805 (TRS)	940-2030501
R28	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R29	SMD 20K 0.1W 5% RES 0805 (TRS)	940-2030501
R30	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R31	SMD 20K 0.1W 5% RES 0805 (TRS)	940-2030501
R32	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R33	SMD 20K 0.1W 5% RES 0805 (TRS)	940-2030501
R34	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R35	SMD 20K 0.1W 5% RES 0805 (TRS)	940-2030501
R36	SMD 20K 0.1W 5% RES 0805 (TRS)	940-2030501
R37	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R38	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R39	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R40	SMD 1K 0.1W 5% RES 0805 (TRS)	940-1020501
R41	SMD 20K 0.1W 5% RES 0805 (TRS)	940-2030501
R42	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501

R43	SMD 20K 0.1W 5% RES 0805 (TRS)	940-2030501
R44	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R45	SMD 20K 0.1W 5% RES 0805 (TRS)	940-2030501
R46	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R47	SMD 20K 0.1W 5% RES 0805 (TRS)	940-2030501
R48	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R49	SMD 20K 0.1W 5% RES 0805 (TRS)	940-2030501
R50	SMD 20K 0.1W 5% RES 0805 (TRS)	940-2030501
R51	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R52	SMD 1K 0.1W 5% RES 0805 (TRS)	940-1020501
R53	SMD 10M 0.1W 5% RES 0805 (TR)	940-1060501
R54	SMD 910K 0.1W 5% RES 0805 (TRS)	940-9140501
R55	SMD 3R9 0.1W 5% RES 0805 (TRS)	940-0390501
R56	SMD 4K7 0.1W 5% RES 0805 (TRS)	940-4720501
R57	SMD 1K 0.1W 5% RES 0805 (TRS)	940-1020501
R58	SMD 100R 0.1W 5% RES 0805 (TRS)	940-1010501
R59	SMD 2K2 0.1W 5% RES 0805 (TRS)	940-2220501
R60	SMD 4K7 0.1W 5% RES 0805 (TRS)	940-4720501
R61	SMD 100R 0.1W 5% RES 0805 (TRS)	940-1010501
R62	SMD 4K7 0.1W 5% RES 0805 (TRS)	940-4720501
R63	SMD 4K7 0.1W 5% RES 0805 (TRS)	940-4720501
R64	SMD 20K 0.1W 5% RES 0805 (TRS)	940-2030501
R65	0R4 5W 5% AX/PLUG CER CASE RES	145-0049500
R66	SMD 6K8 0.1W 5% RES 0805 (TRS)	940-6820501
R67	2R2 1W 5% CARBON FILM RES TR	140-0226501
R68	SMD 20K 0.1W 5% RES 0805 (TRS)	940-2030501
R69	SMD 100R 0.1W 5% RES 0805 (TRS)	940-1010501
R70	SMD 4K7 0.1W 5% RES 0805 (TRS)	940-4720501
R71	SMD 20K 0.1W 5% RES 0805 (TRS)	940-2030501
R72	SMD 100R 0.1W 5% RES 0805 (TRS)	940-1010501
R73	SMD 4K7 0.1W 5% RES 0805 (TRS)	940-4720501
R74	SMD 1K 0.1W 5% RES 0805 (TRS)	940-1020501
R75	SMD 1M 0.1W 5% RES 0805 (TRS)	940-1050501
R76	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R77	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R78	SMD 100K 0.1W 5% RES 0805 (TRS)	940-1040501
R79	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R80	SMD 4K7 0.1W 5% RES 0805 (TRS)	940-4720501

ICs

U1	TLC272CP DUAL CMOS OP AMP LOW BIAS (TI)	100-0027201
U2	SDA 2586 8K EE (SIEMENS)	104-0240801
U3	LM393 DUAL COMPARATOR	100-0039300
U4	Z86E3012PSC-4K OTP 28 PIN MSS DISH	808-8630120
U5	REVERSIBLE DC MOTOR DRIVER BA6109	107-0610900
U6	V/REGULATOR-78L12 +12V 100MA TO-92	105-1781200
U7	V/REGULATOR-LM340T5 +5V 1.5A TO-220	105-0034000
U8	V/REGULATOR-LM78M05 +5V 0.5A -T0220	105-0780500
U9	V/REGULATOR-LM338T TO220 5A VARIABLE	105-0338000
U10	LM358/KA358 DUAL OP AMP LOW POWER	100-0035800

Miscellaneous

HS1	HEATSINK-TV216 POWERFIN (TO220)	202-0021600
HS1	KEROTHERM PAD TYPE 86/37 (13.5X37X0.2)	208-0863701
HS1	SPRING CLAMP-7701 TO220 FOR TV216 H/SINK	249-0770100
L1	AXIAL INDUCTOR-18UH 10% DC RES <0.8R TR	130-0180611
PL1	FE CONNECTOR - 12 WAY SIDE ENTRY JST	161-2101210
PL2	PIN HEADER-2WAY FRIC LOCK (JST B 2P-VH)	161-1000204
RL1	RELAY-VSB12-STB 12V TAKAMISAWA	136-0001201
RL2	RELAY-VSB12-STB 12V TAKAMISAWA	136-0001201
SK1	8 POLE PUSH TERMINAL HSP128V-03	163-5000800
X1	FILTER-SFE 10.7MJA 10K-A (MURATA)	173-0107003
X2	XTAL 12MHZ HC49 50 50 10 30	170-0120010
1	CABLE-12WAY 125MM DISH POS FFC	198-0125120
1	SNAP RIVET- SR3555B BLACK PLASTIC RICHCO	247-3555111
1	CABLE ASSY-2WAY DISH POS-IRTE POWER	266-1000021
1	SHIELDING PLATE DISH POS/IRTE	307-0236100
1	COVER - VAC FORMED FOR DISH POS PCB	312-1000281

Differences to main PCB components to accomodate Dish Positioner PCB

MSS 1000 Series

Components added

	TINNED COPPER WIRE LINKS 0.61MM DIA - PMF	999-1099902
DP1-2	WIRE-0.5 X 50MM 9 (INS LENGTH) RED	190-0505015
DP3-4	WIRE-0.5 X 50MM 9 (INS LENGTH) RED	190-0505015
U22	SOCKET 20 WAY TOP ENTRY (HARWIN)	161-2002001
	Z8-BOARD - EPROM 27256 MSS1034-GP ENG DISH POS	805-1000106
PL11	FE CONNECTOR - 12 WAY TOP ENTRY JST	161-2001210
	PILLAR-LCBS-14(RICHO) Z8 BOARD	248-0014002
	DISH SUPPORT MSS1000 SUPPORT PCB AMP/DISH	248-5080100

Components deleted

X3	XTAL 16MHZ HC49U 50/50/-10+60 30PF PAR	170-0160000
U22	8663 PROC MSS1000 ENG/GER	809-8663107

Components changed

	Tuner 1 - PACE PG77G04 2GHZ D/LNB (18/27) F	221-2177042
	becomes	
	Tuner 1 - PACE PG77G04 2.15GHZ D/LNB (18/27) F	221-2178042

MSS 500 Series

Components added

DP1-2	WIRE-0.5 X 50MM 9 (INS LENGTH) RED	190-0505015
DP3-4	WIRE-0.5 X 50MM 9 (INS LENGTH) RED	190-0505015
U22	SOCKET 20 WAY TOP ENTRY (HARWIN)	161-2002001
	Z8-BOARD - EPROM 27256 MSS1034-GP ENG DISH POS	805-1000106
PL11	FE CONNECTOR - 12 WAY TOP ENTRY JST	161-2001210
	PILLAR-LCBS-14(RICHO) Z8 BOARD	248-0014002
PSU1-PSU2	CABLE-55/0.1MM (0.43MM SQ) PVC YELLOW	190-5501210
C7	CER CAP 1NF 2KV 7.5MM 10% HR SERIES TR	159-1029651
C216	1000UF 63V 7.5MM 20% 105C R/E CAP 16X32	855-1086770
C295	CLASS X CAP-100NF 250V 20%	159-1048780
D54	RECT DIODE 300V (FES8FT)	120-0008001
D72	DIODE-BYV96D (PHILIPS) TR	120-0009611
	DISH SUPPORT MSS1000 SUPPORT PCB AMP/DISH	248-5080100
	MOUNTING BRACKET - DUMMY LOAD RESISTOR	305-0500100
	SCREW M3 X 8 P/P TAP.C/W WASHER BLK SEAL	246-3080011
	CABLE ASSY - DUMMY LOAD RESISTOR INC/RES	199-0500100
PL5	PIN HEADER-2WAYFRIC LOCK (JST B VH)	161-1000204
PL38	PIN HEADER-2WAYFRIC LOCK (JST B VH)	161-1000204
R110	220K 2W 5% CARBON FILM RES TR	142-2247501

Components deleted

X3	XTAL 16MHZ HC49U 50/50/-10+60 30PF PAR	170-0160000
U22	8663 PROC MSS1000 ENG/GER	809-8663107

Components changed

	Tuner 1 - PACE PG77G04 2GHZ D/LNB (18/27) F	221-2177042
	becomes	
	Tuner 1 - PACE PG77G04 2.15GHZ D/LNB (18/27) F	221-2178042
R1	10R 2W ±25% METOX NON-SPIRAL RES	143-1007821
	becomes	
R1	6R8 7W 5% WW/CER HOR/PLUGABLE RES	144-0689510

NOTES

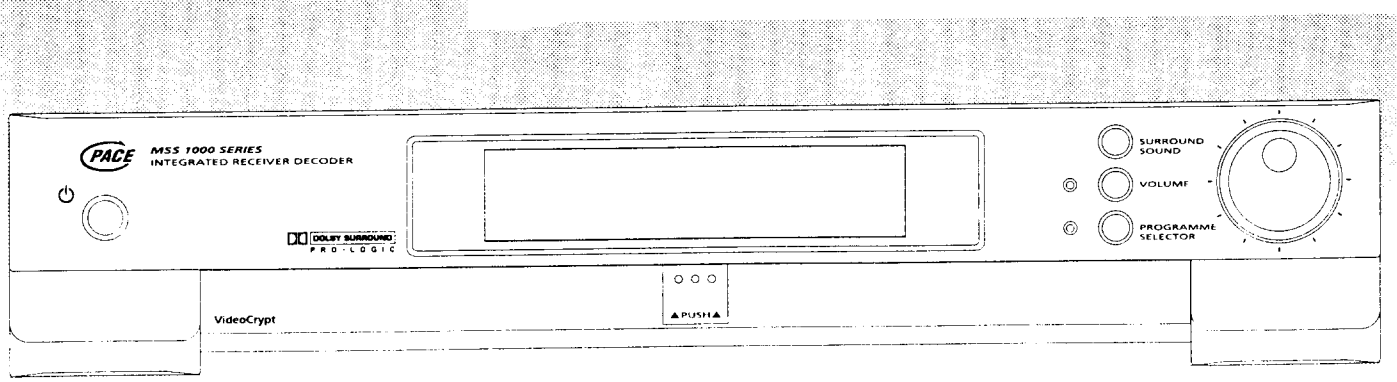
NOTES

Service Manual

MSS 1001-I

INTEGRATED RECEIVER DECODER

ALSO COVERS MSS-1008



PACE MICRO TECHNOLOGY LTD

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IMPORTANT - THIS MANUAL COVERS THE MSS1001-I

NOTE 1: STATUS OF THE PRODUCT

The MSS1001-I contains four PCBs (some units also have a small microprocessor extension PCB). All four PCBs described in this manual are at Revision A3. Each PCB's part number is marked on the component side of the PCB. This number can be read on the appropriate the component ident diagram in this manual, where revision A3 is denoted by the characters 103 at the end of the part number. See the notes on pages 4 and 5 for information on the previous revisions of the PCBs.

The parts lists and circuit diagrams in this manual include information from all Engineering Change Orders (ECOs) up to and including ECO S000517 and all Production Change Orders (PCOs) up to and including PCO S000226, provided that these ECOs and PCOs had an effectivity date on or before 28.03.94. Information on any important changes between this date and the printing date of this manual is given on page 69. Further changes will be given in technical bulletins until this manual is re-issued.

If you need to find out the software version number of the receiver, it is displayed at the start of the display self test sequence (see page 28).

NOTE 2: CIRCUIT DIAGRAM

A sheet containing the circuit diagrams of all four PCBs is in the pocket inside the back cover of this manual.

NOTE 3: VIDEOCRYPT CIRCUIT DESCRIPTION AND DIAGRAMS

For copyright reasons, these have been printed on special paper on a separate sheet, part of which has been overprinted with broad diagonal stripes to prevent photocopying. Each of these sheets has a unique, traceable serial number. As the card reader PCB is intimately linked with the VideoCrypt circuitry, the description of the card reader circuitry is also given on this sheet, which can be found in the pocket at the rear of the manual.

MODEL NUMBERING SYSTEM FOR MSS 1000 AND 500 SERIES RECEIVERS

The first character(s) of the model number dictate the sub-series within the MSS range as follows:

- **10 = MSS 1000 series:**
- **5 = MSS 500 series.**

The MSS 1000 series receivers contain a sound board for home cinema effects (these are not available for the MSS 500 series).

The subsequent characters in the model number have the following meanings:

MSS 10	X	X -	X	X
	Decoder	**Tuner**	**System**	**Polariser/Dish Positioner**
	I	0 = 27 MHz, single LNB	I = PAL I	P = integral
	I	1 = 27 MHz, dual LNB	G = PAL G	No letter = none
	I	2 = 18/27 MHz, single LNB	K = PAL K	
	I	3 = 27/36 MHz, single LNB	L = SECAM L	
	I	4 = 18/27 MHz, dual LNB	etc.	
	I	6 = 27/36 MHz, dual LNB		
	I			

0 = VideoCrypt (2 card readers, UK programme list, English on-screen graphics)
1 = MAC (2 card readers, Scandinavian programme list and on-screen graphics)
2 = VideoCrypt + MAC (4 card readers, Scandinavian programme list and on-screen graphics)
3 = None (continental Europe programme list and multi-lingual on-screen graphics)
etc.

Examples:

MSS 1001-I = home cinema effects, VideoCrypt decoder, 27 MHz dual LNB tuner, PAL I (standard UK model)
MSS 1034-G = home cinema effects, no decoder, 18/27 MHz dual LNB tuner, PAL G (standard "World" model)
MSS 1034-GP = as above, but with integral positioner
MSS 1011-G = home cinema effects, MAC decoder, 27 MHz dual LNB tuner, PAL G

MSS 501-I = VideoCrypt decoder, 27 MHz dual LNB tuner, PAL I (standard UK model)
MSS 534-G = no decoder, 18/27 MHz dual LNB tuner, PAL G (standard "World" model)

PCB REVISIONS

The "revision" numbering (A1, A2, A3 etc.) of all PCBs within the receiver keeps in step so that if one board requires a new revision number then each of the others will also have a new revision number

Early ECOs affected revision A1 boards, but A1 boards were never used in units which were sold. ECO S000345 gave the changes required to revise the boards to A2. There are about 3000 receivers in the field which contain revision A2 PCBs, but the vast majority of these have already been modified in accordance with several ECOs to optimise their performance and effectively bring them up to A3 status.

The following ECOs gave the changes required for upgrading boards to revision A3: ECO S000471A (main), ECO S000465 (sound), ECO S000470 (display) and ECO S000463 (card reader). The A3 revisions of the PCBs are functionally the same as the A2 revisions, the tracking and idents for the A3 boards merely reflect the changes detailed in the A2 revision ECOs. There is a small "V2" after the part number 181-0224103 on the main PCB; this stands for "version 2", but note that version 1 was never manufactured.

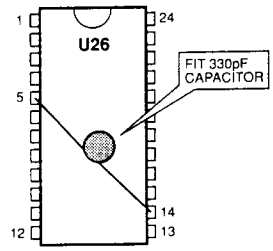
The next revision of the boards is being planned and for this there are some functional differences, primarily the addition of an extra speaker configuration. The manual will be re-issued for this.

There are a few ECOs which need to be mentioned as these may not have been implemented on all A2 or A3 units in the field - see opposite for details.

ECO S000482: Preventing UHF glitching by improving the phase lock of the modulator.

Solution: This is the same for both A2 and A3 revisions of the main PCB.

Decouple pin 14 of U26 to ground by fitting a 330 pF, 100 V, 5 mm, 20% ceramic capacitor (part number 150-3317751) between pins 5 and 14 of U26, as shown in the diagram.

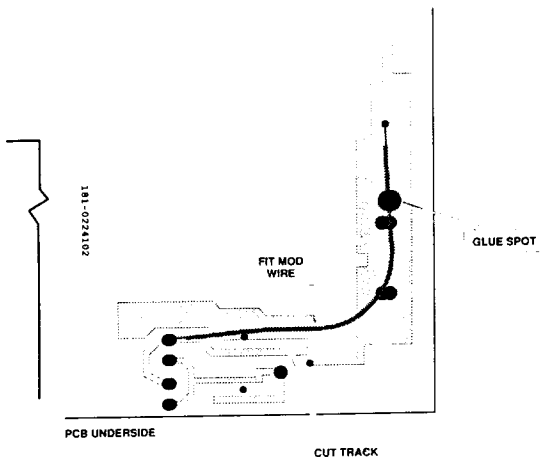


ECO S000498 (for A3 PCB) and part of ECO S000429 (for A2 PCB): Reducing switch mode noise on the audio output from the sound board (may be heard as a whining).

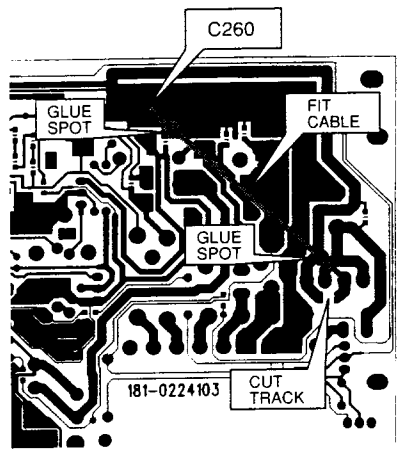
Solution: This is similar but different for the A2 and A3 revisions of the main PCB:

For A2 boards: Cut the track and fit (and secure with glue) a mod wire 0.5 mm x 100 mm red (part number 190-0510015) as shown in the diagram.

For A3 boards: Cut the track and fit a cable - 55/0.1 mm (0.43 mm sq) PVC yellow (part number 190-5501210) from C260 to a point near to the track cut as shown in the diagram. Secure the cable with two glue spots as shown. In addition, use PL38 (instead of PL5) on the main board to connect the power cable from PL4 on the sound board.



Underside of revision A2 main board

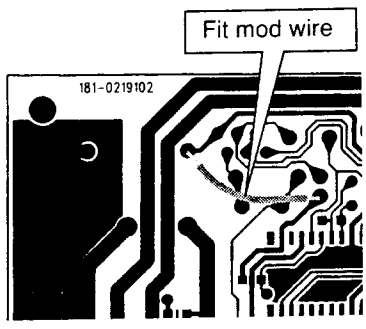


Underside of revision A3 main board

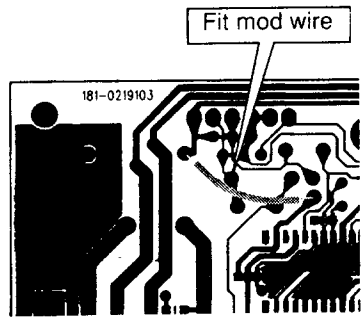
ECO S000535: Reducing the sound board's susceptibility to loss of audio when electrostatic discharges are applied to the unit. Note that PCO S000243 is also relevant.

Solution: This is the same for both A2 and A3 revisions of the sound PCB, but as the board tracking is somewhat different for these two revisions, two diagrams are given.

Fit a mod wire 0.5 mm x 20 mm red (part number 190-0502015) as shown.



Underside of revision A2 sound board



Underside of revision A3 sound board

OUTLINE SPECIFICATION

GENERAL

Number of Programmes	250
Front Panel Control	Standby and Home Cinema buttons; buttons to convert dial to volume control or programme selector
UHF Modulator	CCIR PAL System I, Ch. 21 to 69, preset to Ch. 38
Operating Voltage	187 - 264 V AC, 50 Hz
Power Consumption	160 W (max.)
Dimensions	H = 66 mm, W = 360 mm, D = 320 mm
Weight	4.4 kg (typical, when packed)

CONNECTORS

TV	SCART (RGB and CVBS)
VCR	SCART (CVBS)
AV1 (AUX)	SCART
AV2 (DECODER/DESCRAMBLER)	SCART (Baseband Output, Audio/Video Input/Output, RGB in)
SPEAKERS	4 (right front, left front, surround and centre or surround) connected speakers must have an impedance between 4 Ω and 8 Ω
EXTERNAL AMPLIFIERS OUT	Phono (Left, Right, Centre, Surround, Surround)
MAINS INPUT	2-pin reversible
AERIAL	IEC female
TV	IEC male
LNB	Dual F-type

TUNER

Receiving Frequency Range	920 - 2050 MHz
Polarity Switching	Vertical: 11.8 - 14.0 V, Horizontal: 17.0 - 19.6 V at 0 - 250 mA with short circuit protection
LNB Tone Switching	Amplitude: 0.6 V ±0.2 V, Frequency: 22 kHz ±4 kHz
Input Impedance	75 Ω
I. F.	479.5 MHz
I. F. Bandwidth	27 MHz
Input Level	-60 dBm to -30 dBm
Image Rejection	40 dB (typically)
Static Threshold	6 dB (typically)
Energy Dispersion Removal	35 dB (min.)

SCART CONNECTORS

Video Output Level	1 V p-p (±2 dB)
Video Output Impedance	75 Ω
Video Frequency Range	25 Hz - 4.8 MHz (±1.5 dB)
Video De-emphasis (PAL)	to CCIR 405.1 (625 lines)
Baseband Output Level	1 V p-p (±2 dB)
Baseband Frequency Range	25 Hz - 10.5 MHz (±1.5 dB)
Baseband De-emphasis	PAL/MAC, software selectable
Audio Frequency Range	30 Hz - 15 kHz
Audio Output Level	500 mV rms into 600 Ω

OPERATING/STORAGE CONDITIONS

Operating Temperature Range	5 - 40 °C
Operating Humidity Range	20 - 80% non-condensing at 25 °C
Storage Temperature Range	-20 - +50 °C
Storage Humidity Range	10 - 90% non-condensing at 25 °C

OUTLINE SPECIFICATION (cont.)

AUDIO

Audio Bandwidth	130, 180, 200, 280 or 380 kHz
Audio De-emphasis	PANDA 1, 50 µs, 75 µs or J17
Tuning Frequency Range	5.00 - 9.00 MHz in 10 kHz steps left and right frequencies independently tunable

KU-Band preset audio modes

Mode	Frequency	De-emphasis	Bandwidth
Stereo A	7.02 & 7.20 MHz	PANDA 1	130 kHz
Stereo B	7.38 & 7.56 MHz	PANDA 1	130 kHz
Stereo C	7.74 & 7.92 MHz	PANDA 1	130 kHz
Stereo D	8.10 & 8.28 MHz	PANDA 1	130 kHz
Mono 1	6.50 MHz	50 µs	180 kHz
Mono 2	7.02 MHz	PANDA 1	130 kHz
Mono 3	7.20 MHz	PANDA 1	130 kHz
Mono 4	7.38 MHz	PANDA 1	130 kHz
Mono 5	7.56 MHz	PANDA 1	130 kHz
Mono 6	7.74 MHz	PANDA 1	130 kHz
Mono 7	7.92 MHz	PANDA 1	130 kHz
Mono 8	8.10 MHz	PANDA 1	130 kHz
Mono 9	8.28 MHz	PANDA 1	130 kHz

PIN DESIGNATIONS FOR SCART CONNECTORS

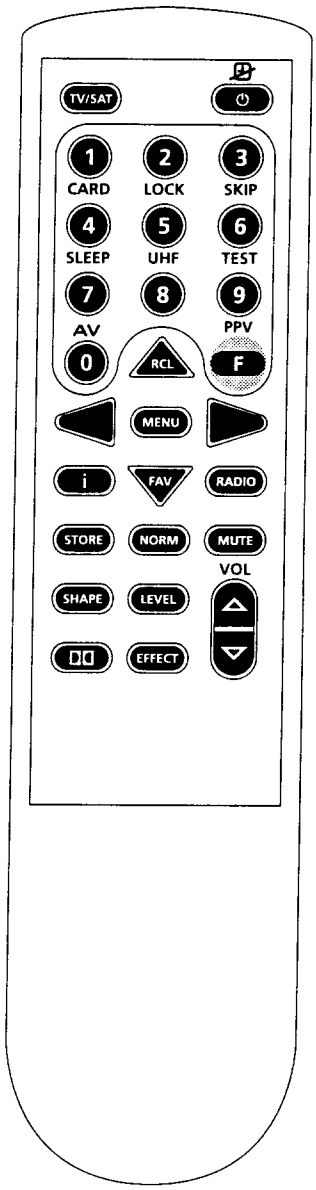
Socket Viewed from Rear Panel

NOTE: The four SCART connectors are actually two double-SCART connectors mounted on the main PCB. On the circuit diagram these are SK2 and SK3 and the pins are numbered from 1 to 42, as shown in the table below. Example: Pin 3 of the VCR SCART is Left Audio Out and is shown as pin 24 on the circuit diagram.

Pin	TV SCART (SK2)	Pin	VCR SCART (SK2)	Pin	AV1 (AUX) SCART (SK3)	Pin	AV2 (DEC) SCART(SK3)
1	R Audio Out	22	R Audio Out	22	R Audio Out	1	R Audio Out
2	R Audio In	23	R Audio In	23	R Audio In	2	R Audio In
3	L Audio Out	24	L Audio Out	24	L Audio Out	3	L Audio Out
4	Audio Ground	25	Audio Ground	25	Audio Ground	4	Audio Ground
5	Blue Ground	26	Ground	26	Ground	5	Blue Ground
6	L Audio In	27	L Audio In	27	L Audio In	6	L Audio In
7	Blue Out	28	Not connected	28	Not connected	7	Blue In
8	AV Status Out	29	VCR Status In	29	Ext. Aux. Status In	8	Ext. Decoder Status In
9	Green Ground	30	Ground	30	Ground	9	Green Ground
10	Not connected	31	Not connected	31	Not connected	10	Not connected
11	Green Out	32	Not connected	32	Not connected	11	Green In
12	Not connected	33	Not connected	33	Not connected	12	Serial Data I/O Port
13	Red Ground	34	Ground	34	Ground	13	Red Ground
14	Not connected	35	Not connected	35	Not connected	14	Not connected
15	Red/SVHS Chroma Out	36	SVHS Chroma	36	Not connected	15	Red In
16	RGB Status Out	37	Not connected	37	Not connected	16	RGB Status In
17	Video Ground	38	Video Ground	38	Video Ground	17	Video Ground
18	Ground	39	Ground	39	Ground	18	Ground
19	Video Out	40	Video Out	40	Baseband Video Out	19	Baseband Video Out
20	Video In	41	Video In	41	Video In	20	Video In
21	Ground (Casing)	42	Ground (Casing)	42	Ground (Casing)	21	Ground (Casing)

REMOTE CONTROL HANDSET AND FRONT PANEL CONTROLS

When an operation is described in this manual, it is often given pictorially, as shown right which means: Press the MENU key, then press the 5 key, then press the 2 key.



Key(s):	Use:
TV/SAT	To switch between satellite TV, terrestrial TV and VCR (if the receiver, TV and VCR are connected by SCART leads)
⏻	To put the receiver into and out of standby
0 to 9	To select programmes; to move between menus (sometimes to change menu values)
AV 0	To select external audio/video (AV) sources
RCL	To recall the last programme
F	F (function) key - used with the other keys to give "short-cut" methods for certain functions (e.g. LOCK)
MENU	To display Main Menu on screen; to move back up the menu tree to previous menus
▲ ▼	To select menu options (move within menu)
◀ ▶	To step through programmes in normal viewing mode; with F key to scan through programmes; to change values in menus
STORE	To store changes and leave menu to return to normal viewing mode
NORM	To leave menu without storing changes and return to normal viewing mode
i	To display programme information and help text for menus
FAV	To select favourite categories
RADIO	To select satellite radio programmes
MUTE	To mute the sound
SHAPE	To select a sound shape (treble/bass mix)
LEVEL	To set speaker levels
DD EFFECT	To select home cinema effects (DD for sound mode, EFFECT for added effects)
VOL ▲ ▼	Volume (rocker) key

Front Panel Controls

There is a front panel button to switch the receiver into and out of standby.

The button labelled "SURROUND SOUND" can be used to select the four sound modes.

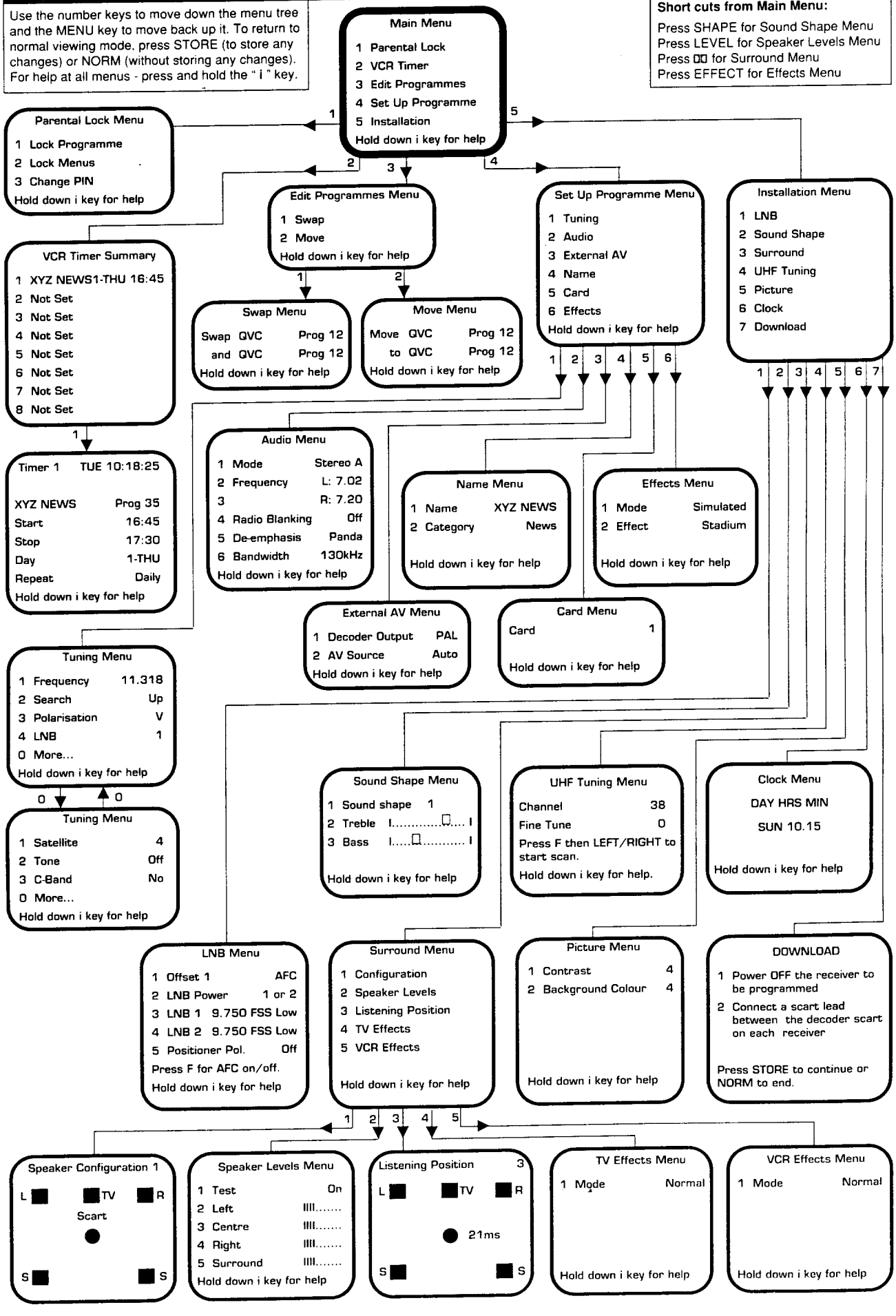
Pressing the button labelled "VOLUME" converts the front panel dial into a volume control; pressing the button labelled "PROGRAMME SELECTOR" allows you to select programmes using the dial.

MENU TREE (showing, in most cases, the default settings - see also page 15)

Use the number keys to move down the menu tree and the MENU key to move back up it. To return to normal viewing mode, press STORE (to store any changes) or NORM (without storing any changes). For help at all menus - press and hold the " i " key.

Short cuts from Main Menu:

Press SHAPE for Sound Shape Menu
Press LEVEL for Speaker Levels Menu
Press ▯▯ for Surround Menu
Press EFFECT for Effects Menu



UHF TUNING

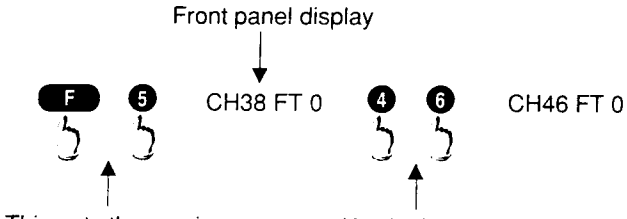
The receiver has been preset at the factory to UHF channel 38, so if you tune the TV (and VCR if necessary) to channel 38, it will automatically be tuned to the receiver. If the TV's channel 38 is not free, then you can tune the receiver to any other channel in the range 21 to 69.

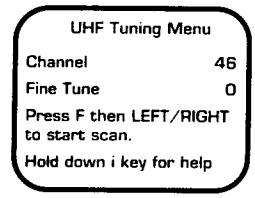
Tuning the Receiver to a UHF Channel

Set up the TV to the required UHF channel and assign it to one of the TV handset keys (e.g. the 5 key). If you find a clear TV channel but do not know its number you can use the "channel scan" feature - see the next section.

Plug the receiver into the mains and bring it out of standby mode.

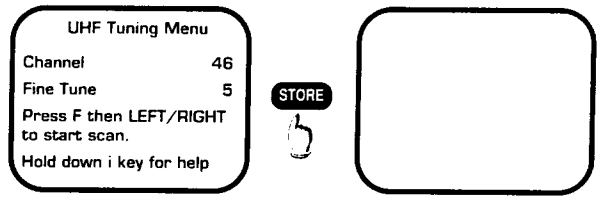
E.g. Tuning to UHF channel 46



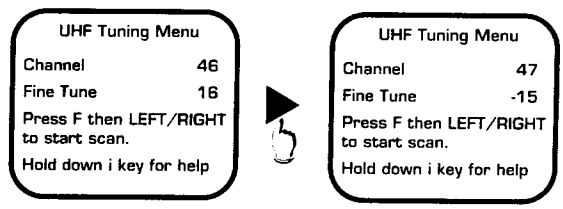


The menu appears, showing the chosen channel number.

To get the best picture, you can fine tune between -15 and +16. In the case shown right, the front panel would show CH46 FT 5.



Note that if the "Fine Tune" option is selected and you press the ▶ key when +16 is displayed, the fine tune value becomes -15, but the channel number increases by one as shown. A channel with a fine tune value of +16 is the same as the next channel with a fine tune value of -15.


UHF Tuning Menu
Channel 46
Fine Tune 16
Press F then LEFT/RIGHT to start scan.
Hold down i key for help
UHF Tuning Menu
Channel 47
Fine Tune -15
Press F then LEFT/RIGHT to start scan.
Hold down i key for help

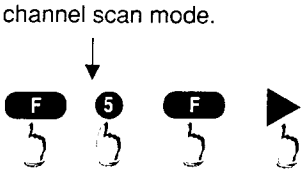
Using the UHF Channel Scan Feature

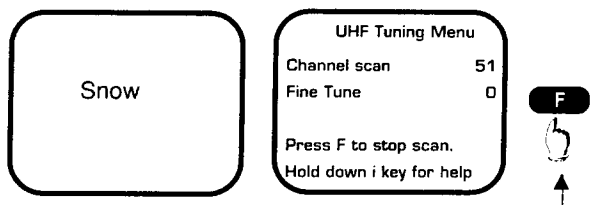
This is an alternative method for tuning the receiver to a UHF channel. It is useful if you find a TV handset key which gives a clear UHF channel, but do not know the number of this UHF channel.

The example below shows channel 51 as the UHF channel which corresponds to the chosen TV handset key.

Plug the receiver into the mains and bring it out of standby mode.

This puts the receiver into channel scan mode.





The TV screen displays only snow until the correct channel number is reached, then the menu appears.

To stop the scan

If you did not stop it at exactly the correct channel to put the menu on the screen, press the ◀ or ▶ key until you do see the menu.

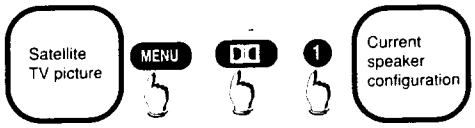
The front panel display keeps changing.

CH38 FT 0.....CH43 FT 0.....CH51 FT 0

DON'T FORGET - fine tune if required, then press the STORE key to store the UHF tuning settings.

SETTING UP THE SPEAKER CONFIGURATION

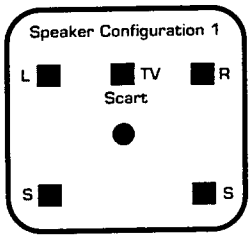
Displaying the Current Speaker Configuration



Selecting the Appropriate Speaker Configuration

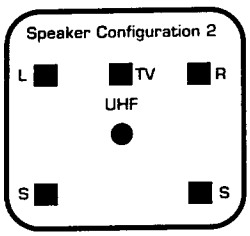
• shows the ideal listening position.
L = left front, C = centre, R = right front, S = surround,
TV = TV used as centre speaker

Select the configuration which corresponds to the way the speakers have been installed.

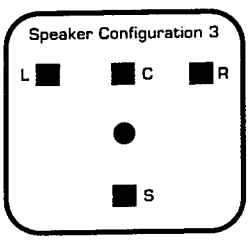


Choose this if you want the TV as a centre speaker and it is connected to the receiver by a SCART lead. See also the notes (right) if there is an installed UHF splitter.

NOTE: This is the factory-set configuration.

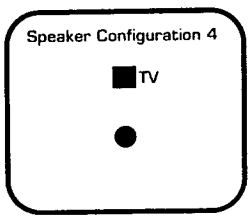


Choose this if you want the TV as a centre speaker and it is connected to your receiver by UHF only. See also the notes (right) if there is an installed UHF splitter.



Choose this if you want a separate centre speaker.

For a SCART connection, the receiver automatically mutes the TV's sound so that you hear the centre speaker; for a UHF connection, you must mute the TV's sound.



You MUST choose and store this configuration if there are no external speakers.

NOTE: You cannot then select any home cinema effects.

Connecting the Speakers

Attaching the speakers at the rear panel connects them to 4 internal amplifiers for:

- front left;
- front right;
- surround;
- a fourth (labelled CTR/SUR) for the centre speaker or a second surround speaker.

***NOTE:** Speakers must have an impedance between 4 Ω and 8 Ω.*

If you connect 2 surround speakers, you can still have a centre speaker by using:

- the TV's internal amplifier and speaker; or
- a separate external amplifier and speaker.

You need a centre speaker to get the full benefit of the Pro Logic and 3 Channel modes.

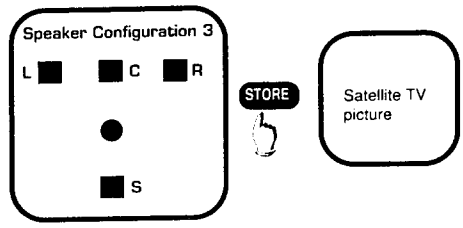
Installed UHF Splitter

IMPORTANT - if there is a UHF splitter to feed other TV sets, you can only use the TV as a centre speaker as follows:

Connect the TV to the receiver by a SCART lead **as well as** the UHF cable and choose Configuration 1.

***NOTE:** If you choose Configuration 2, only the **centre** speaker information (which may not always be present) will be fed to the other TV sets.*

Storing the Configuration



***NOTE:** To leave the menu without storing your changes, press the NORM key.*

SETTING UP THE RECEIVER FOR THE ATTACHED LNB(S)

IT IS VERY IMPORTANT to check that the LNB option(s) on the LNB Menu corresponds with the LNB(s) on the attached dish antenna(s).

The receiver was preset at the factory as follows:

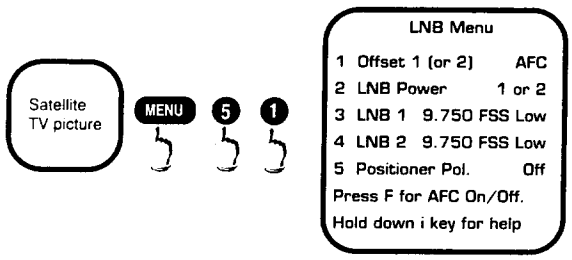
- LNB 1 9.750 FSS Low
- LNB 2 9.750 FSS Low

(i.e. for LNBs with a local oscillator whose frequency is 9.750 GHz)

Make sure you know the frequency of the LNB's local oscillator before you connect it to the receiver. Then check that the appropriate LNB option at the LNB Menu corresponds with this.

***NOTE:** If you are attaching a C-Band LNB, see page 13.*

Reaching the LNB Menu



What can happen if an LNB is set incorrectly

If an LNB setting does not correspond with the attached LNB, there can be problems as follows:

- if you set "FSS High" at the LNB Menu and your LNB is not suitable for "FSS High" (or, conversely, you have attached an "FSS High" LNB, but set a different value at the menu) then the receiver retunes to a different frequency, so that you see a different programme or even no programme at all on the screen

  (e.g. the programme which was SKY NEWS retunes to become CNN or GALAVISION);

- in other cases the receiver does not retune (i.e. the same programme remains on the screen) but the frequency displayed at the **Tuning Menu** may not be correct.

Changing the LNB Setting

Select one of the following bands for LNB 1 or choose the setting "Variable" (see below).

LNB Band	Freq. Range (GHz)	Typical Satellites
9.750 FSS Low	10.700 - 11.800	Astra 1A, 1B, 1C, 1D / Intelsat / Eutelsat
10.000 FSS High	10.920 - 11.700	Astra 1A, 1B, 1C / Intelsat / Eutelsat
10.750 DBS	11.700 - 12.500	TDF / TV-Sat / Hispasat
11.475 Telecom	12.500 - 12.750	Telecom 2A, 2B, 1C

The numbers in the LNB band names are the frequencies (in GHz) of the LNB's local oscillator. The second column shows the frequency range over which you **should** tune at the Tuning Menu. We do not recommended that you tune outside these ranges, as performance cannot then be guaranteed.

Set LNB 2 (if applicable) to the appropriate LNB band as described above.

Changing the "Variable" Setting

Select "Variable" (the number next to it flashes). Use the number keys to key in the LNB's local oscillator frequency (in the range 9.050 to 13.000 GHz).

***IMPORTANT:** If your LNB's local oscillator frequency is 10.000 GHz, set 10.000 FSS High (**not** 10.000 Variable).*

How to check that the LNB option is correct

Store a setting for the LNB at this LNB Menu, and align the dish with the Astra satellite.

In normal viewing mode, key in the programme number for SKY NEWS (consult the programme list), then display the Tuning Menu (by pressing MENU, 4, 1). Check if you can see the SKY logo in the picture on the screen. Check the frequency displayed in the top line of the menu.

If you can see SKY NEWS **AND** the frequency is correct (as on the programme list), then the LNB option at the LNB Menu is correct. If you cannot see the SKY logo **OR** the frequency is wrong, the LNB option has been set incorrectly.

***NOTE:** Ensure that you see SKY NEWS and **not** CNN or GALAVISION, even if the frequency displayed is correct.*

Setting up the Receiver for a C-Band LNB

You can attach a C-Band LNB to 1 or 2. You cannot set up the receiver for C-Band at the LNB Menu. You must set up each C-Band programme individually at the Tuning Menu.

C-Band is the only case where it does not matter how LNB 1 (or LNB 2) is set at the LNB Menu.

Changing the Offset

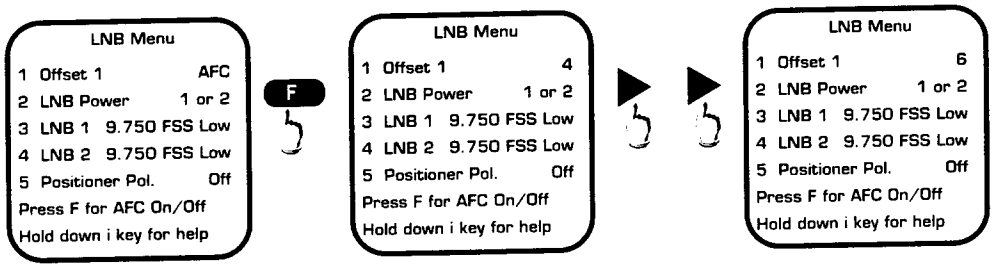
You cannot adjust the offset until you have aligned the dish and can see some programmes.

The receiver has been factory-preset for automatic offset (called AFC). This should give a good picture with few or no speckles. You should not need to alter this unless you are trying to receive a very weak signal with a speckled picture.

NOTE: *When the satellite receiver is being used with an attached dish positioner, there may be some drifting (causing poor picture quality) when AFC is on. Switch AFC off to stop the drifting.*

To override AFC, select a programme being received at LNB 1 (to give "Offset 1" when you reach the LNB Menu).

Set the offset between -15 to +15 to give the best picture, with an even mix of black and white speckles.


LNB Menu
1 Offset 1 AFC
2 LNB Power 1 or 2
3 LNB 1 9.750 FSS Low
4 LNB 2 9.750 FSS Low
5 Positioner Pol. Off
Press F for AFC On/Off
Hold down i key for help
F
LNB Menu
1 Offset 1 4
2 LNB Power 1 or 2
3 LNB 1 9.750 FSS Low
4 LNB 2 9.750 FSS Low
5 Positioner Pol. Off
Press F for AFC On/Off
Hold down i key for help
LNB Menu
1 Offset 1 6
2 LNB Power 1 or 2
3 LNB 1 9.750 FSS Low
4 LNB 2 9.750 FSS Low
5 Positioner Pol. Off
Press F for AFC On/Off
Hold down i key for help

To change the offset for LNB 2, first press STORE to save "Offset 1" and return to normal viewing mode. Select a programme being received at LNB 2, then redisplay the LNB Menu to change "Offset 2" as shown above.

Turning the LNB Power On/Off

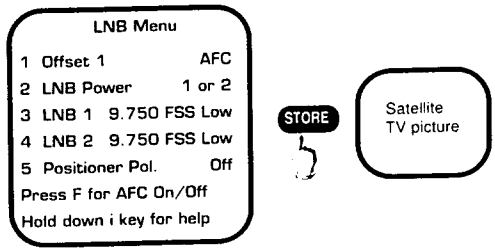
The receiver should provide power to the LNB(s) unless an LNB is on a communal antenna (in which case it must NOT receive power from the receiver).

Setting	What is powered
None	both LNBs never powered from the receiver
1	LNB 1 always powered; LNB 2 never powered
2	LNB 2 always powered; LNB 1 never powered
1 or 2	power can go to both LNBs from the receiver (and, at any one time, goes to the LNB which is receiving the current programme)

Setting the Positioner Polarisation

Set this to "On" only if you have attached certain Pace MSP995 positioners and wish the polarisation you set at the Tuning Menu to "overrule" the polarisation you set at the positioner (see also the positioner manual).

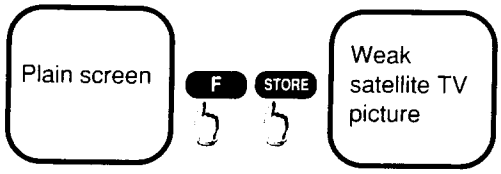
Storing the LNB settings


LNB Menu
1 Offset 1 AFC
2 LNB Power 1 or 2
3 LNB 1 9.750 FSS Low
4 LNB 2 9.750 FSS Low
5 Positioner Pol. Off
Press F for AFC On/Off
Hold down i key for help
STORE
Satellite TV picture

NOTE: *To leave the menu without storing your changes, press the NORM key.*

Cancelling a Plain Screen

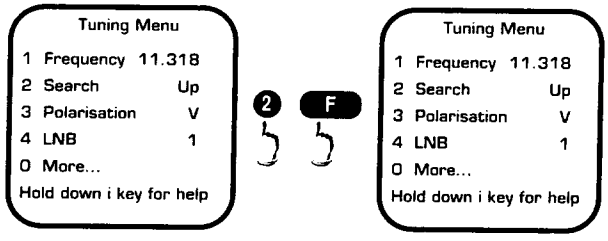
When you are tuning in to weak signals the receiver may force a plain colour onto the TV screen and display "NO SIGNAL". To help you to see weak signals, cancel this plain screen as follows, (this only works if there is no menu on the screen):



NOTE: *To redisplay the plain screen, press F, STORE again.*

Using the Fast Frequency Scan Feature

Press MENU, 4, 1 to display the Tuning Menu and start the fast scan as follows:



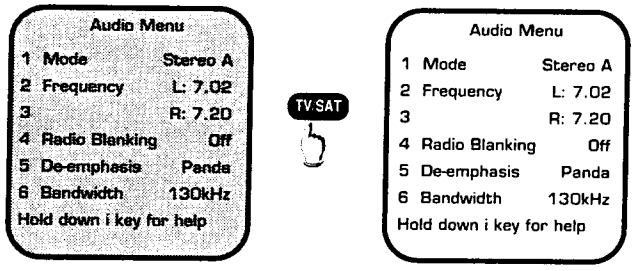
Fast scan mode

In "fast scan" mode the receiver scans quickly through the whole frequency band and weak signals do not force a plain screen. This can be a useful way to align the dish if you have no installation meter.

Look at the TV screen and move the dish until you can see stronger signals, then press the F key to stop the fast scan and return to the Tuning Menu.

Forcing a Plain Background for Menus

Sometimes, when there is a scrambled or distorted picture on the screen, a menu may be difficult to read. You can force a plain background as follows:



distorted background

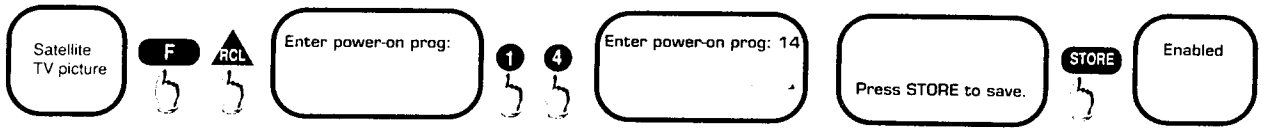
plain coloured background

NOTE: *To remove the plain background, press the TV/SAT key again.*

Setting Up the Receiver to Display a Programme when it is Powered On

Generally when you plug the receiver into the mains it will power up in standby mode. The feature described here can be useful if the receiver is in a communal (SMATV) system. We do not recommend it for individual installations.

The example given is for programme 14:

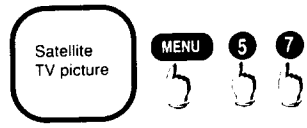


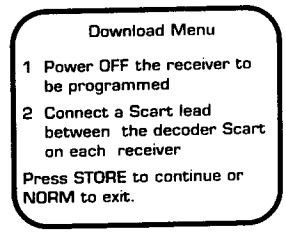
NOTE: *To cancel the feature, repeat the above process.*

DOWNLOAD

You use this feature to "program" another receiver of the same type. During the download, all of the information stored in the first receiver's internal memory is transferred to the second receiver. This includes all the settings which have been made and stored at the menus, except the clock setting and any timers that have been set up.

Reaching the Download Menu




Download Menu
1 Power OFF the receiver to be programmed
2 Connect a Scart lead between the decoder Scart on each receiver
Press STORE to continue or NORM to exit.

IMPORTANT NOTE: *You must follow the on-screen instructions exactly, otherwise errors may occur.*

Display the Download Menu on the receiver you are downloading **from**.

Turn off the power to the receiver you want to download **to**.

Connect a SCART lead between the AV2 (DECODER/DESCRAMBLER) connector on the rear panel of each receiver.

Press the STORE key.

Turn on the power to the receiver you want to download **to**.

NOTE: *The number on the screen is the software version number.*

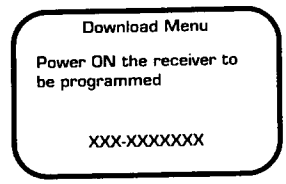
Press the STORE key.

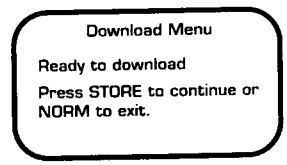
NOTE: *At any stage up to this pressing of the STORE key, you can stop the download by pressing the NORM key.*

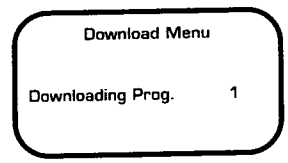
During download "global" information is transferred first, then all the programme information. Messages appear on the screen to tell you which programme is currently being transferred. Download takes about 15 seconds.

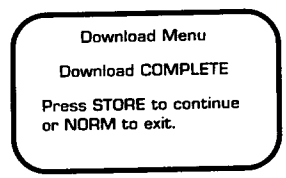
When the message "Download COMPLETE" appears, disconnect the receiver you have downloaded **to**. Press the STORE key to redisplay the Installation Menu if you wish to download to another receiver, otherwise press NORM to return to normal viewing mode.

If the download fails for any reason, the message "Download ERROR" appears.









RESETTING THE PIN AND GLOBAL RESET

The factory-set PIN is 1234. You can reset any customised PIN to the factory default as follows:

At the wall socket, disconnect the receiver from the mains supply. Hold down the ⏻ button **on the receiver's front panel** while you reconnect the receiver at the wall socket. You need to hold down the ⏻ button until the message "RESET PIN" disappears from the front panel display.

When the PIN is reset, the following also occur: any locked programmes or menus become unlocked, and, because the receiver has been powered down, the clock and any timers are no longer set.

Global Reset

To perform a global reset: Press the MENU key to put the Main Menu on the screen, then press the following keys in quick succession: 0 then STORE then ► then ◄.

A global reset causes the following to happen:

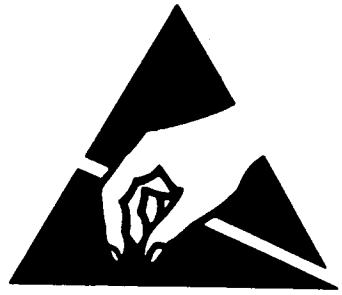
- All the options in the "Installation" sub-menus are reset to the values shown in the Menu Tree on page 9, **but note that in some early models of the receiver, LNB 1 and LNB 2 will be reset to 10.000 FSS High** (and not to 9.750 FSS Low which was downloaded at the factory). **This has important implications - see page 12.**
- The PIN is reset to 1234 and, if locked, the menus become unlocked (locked programmes are not affected). As you have not powered down the receiver for a global reset, the clock and timer settings are not lost.
- All the volume controls are reset to "half way"; the sound shapes are reset to those depicted in the User Manual.
- If a "power-on" programme has been set (see page 14), the receiver is reset to power up into standby.
- Any sound modes which have been stored against AV1 and AV2 are reset to Normal mode.
- If you have a receiver which had special preset audio modes downloaded at the factory, these are reset to the standard Astra audio modes listed on page 7.

NOTE 1: As the UHF channel resets to 38, fine tune 0, you may need to do UHF tuning again (see page 10).

NOTE 2: As the receiver is reset to Speaker Configuration 1, you may need to alter this (depending on how the speakers and TV are actually set up) to hear the sound properly (see page 11).

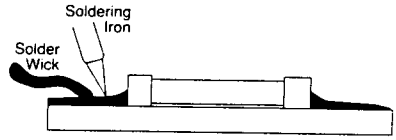
WORKING WITH CHIP COMPONENTS

Handling Electrostatic Sensitive (ES) Devices



Many semiconductor devices, such as integrated circuits and field effect transistors, can easily be damaged by static electricity. The following precautions should be observed when ES devices are being handled.

- Always use a grounded tip soldering iron and anti-static type solder removal devices.
- Before handling a device, discharge any electrostatic charge on your body by touching a known earth point - preferably use an earthed bench mat or ground mat together with a wrist strap.
- Do not remove an ES device from its protective packing until you are ready to fit it. Touch the protective material to the chassis or the assembly in which the ES device is to be installed, before removing the device from its packing.

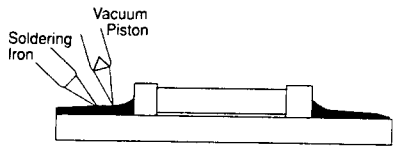


General Precautions for Handling and Storing Chips

Do not handle chips with your bare hands as this can cause oxidation on the chip's terminals which leads to poor soldering.

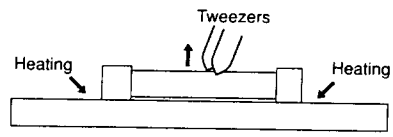
Do not store the chips in any of the following areas, as oxidation will occur and the capacitance and resistance will be affected:

- areas with sulphur or chlorine gas;
- direct sunlight;
- areas of high temperature and/or high humidity.



Rough handling of circuit boards containing surface mount devices can cause damage to the components as well as the board; never bend or flex such boards.

Do not heat or cool the boards unnecessarily, as the board materials expand and contract by differing amounts which can cause the components and solder connections to be stressed.

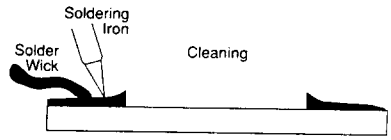


Never rub or scrape chip components as this can change their value. Do not slide the board across any surface.

General Precautions for Attaching and Removing Chips

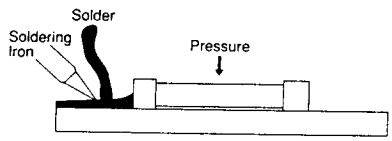
When using a soldering iron, take care and apply suitable pressure.

For preference, use a soldering iron rated at approx. 30 W with a thermostatic control to give soldering temperatures of approx. 225 to 250 °C.



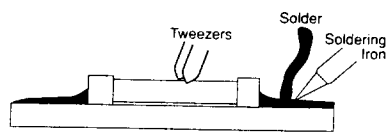
Do not re-use chips which have been removed from the board.

When attaching chips, solder as quickly as possible so as not to damage the terminals and body of the chip. Do not touch the terminals directly with the soldering iron.



While soldering, keep the chip's body in contact with the board.

Removing a Chip



Heat the solder for 2 to 3 seconds at each terminal of the chip.

Remove the molten solder with solder wick.

Holding the chip with a pair of tweezers, remove it gently from the board while the solder at each terminal is molten.

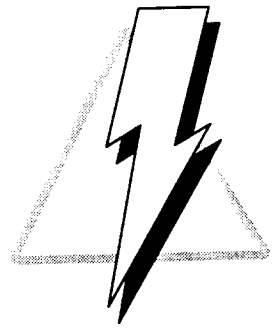
Wick off all excess solder from the board, so that it is ready for the mounting of new components.

Attaching a Chip

Place the chip in the correct position and temporarily solder one terminal to the copper surface.

Holding the chip body with a pair of tweezers to position it accurately, complete the soldering at each terminal in turn.

GAINING ACCESS TO THE UNIT



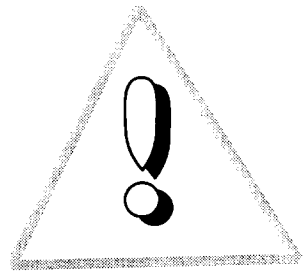
REMEMBER - SAFETY FIRST

WARNING: Always disconnect the unit from the mains supply before dismantling it.

WARNING: Remove your wrist strap before applying power to the re-assembled equipment to avoid potential shock hazards.

WARNING: The incorrect substitution of electrolytic capacitors may result in an explosion hazard.

CAUTION: Work on an earth mat and wear a wrist strap and earth lead to prevent electrostatic damage to components. Once the main board is removed from the casing it is fairly flexible, so handle it carefully to avoid damaging the components.



CAUTION: You must replace all the PCB fixings, screws etc. when the unit is re-assembled, otherwise there could be hazards due to reduced clearances.

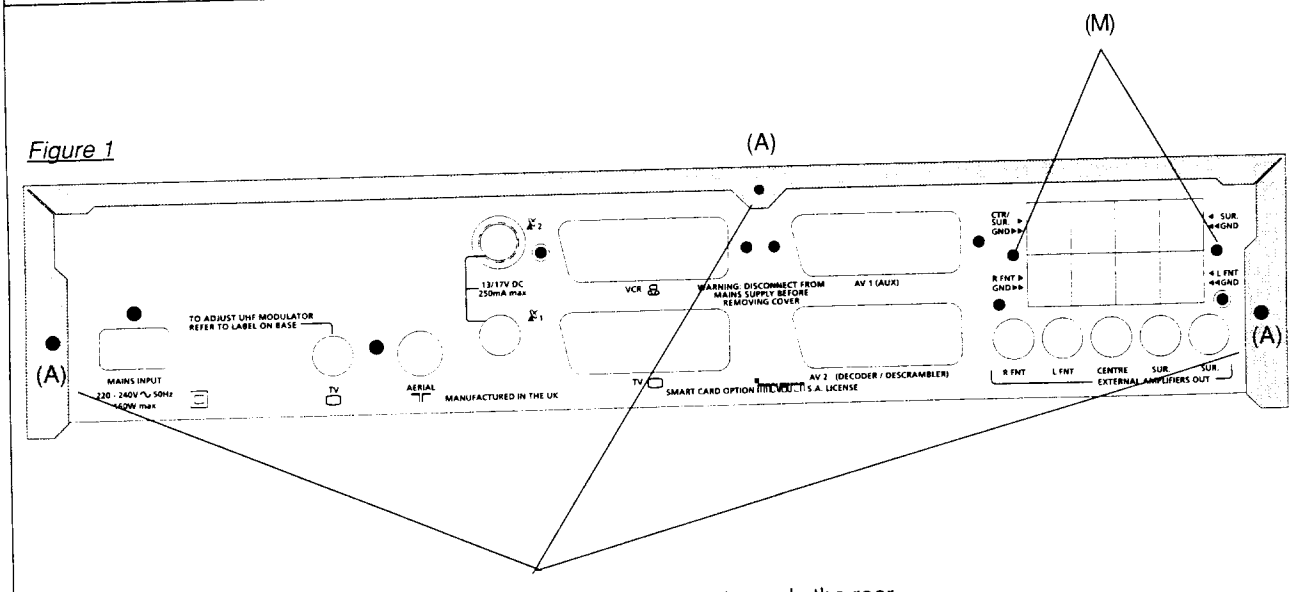
CAUTION: Before you apply mains power to the unit, always ensure that the voltage rating stated on the rear panel of the unit matches the mains voltage supply in the country of installation.

CAUTION: Do not spray chemicals on or near the unit.

CAUTION: Replacements for faulty components must be of the correct value and rating and must be assembled by a competent service engineer, otherwise safety approvals could be invalidated.

Removing the Cover (Figure 1)

Figure 1



Remove the 3 taptite screws (A) and slide the cover towards the rear.

CIRCUIT DESCRIPTION

The receiver comprises four PCBs: the main board, the sound board, the display board and the card reader board. Some receivers may have an extension board in place of the main microprocessor U22 (see also the section entitled "Control Circuitry" later in this circuit description)

The adjacent "main" block diagram shows most of the main functional blocks. The VideoCrypt circuitry is on the main PCB but, for copyright reasons, the VideoCrypt decoder functions are given in a block diagram on a separate sheet. (See the pocket on the rear cover of the manual.) This separate sheet also contains a VideoCrypt circuit diagram and descriptions of the VideoCrypt and card reader functionality. There is also a separate block diagram for the audio circuitry (on page 30) which includes both the main board and sound board functions.

Where possible, a margin has been left alongside the circuit descriptions for you to add your own notes.

TUNER AND VIDEO PROCESSING (MAIN BOARD)

Tuner

When a programme is selected via the handset, data received by the sensor IR1 on the display board is fed, as TTL level data, to the microprocessor U1 for decoding. On the main board, microprocessor U22 receives data from U1 and supplies tuning data to a frequency synthesiser within the video processor U26. This synthesiser forms the reference oscillator for the phase locked loop which controls the local oscillator in the tuner (TUNER1). The prescaler output of the tuner is obtained by dividing the local oscillator frequency by 128.

The local oscillator is set 479.5 MHz higher in frequency than the chosen programme and is mixed with the incoming signal. The signal is then amplified by an IF stage centred at 479.5 MHz with a bandwidth of 27 MHz. The 479.5 MHz FM signal is then demodulated in TUNER1 to give the required composite video baseband signal (CVBS) output.

The frequency synthesis is performed by U26, which receives divider ratio data for the required programme at pin 15 via the 3-wire serial bus from the microprocessor U22. The data is on pin 15, clock on pin 19 and select on pin 11 of U26. The synthesiser generates a reference frequency from the 4 MHz clock input on pin 12 of U26. This 4 MHz clock input is from the 16 MHz oscillator X3, which is divided by 2 in divider U31B and again by 2 in U31A. The prescaler input on pin 18 of U26 is divided down according to the divider ratio data sent from U22 and compared with the generated reference (see also the diagram on page 19). The error signal from this phase locked loop (pulses on pin 16 of U26) is integrated by Q52, C187, R315, R316 and R317. These determine how much of the 27 V supply appears as the tuner control voltage on pin 15 of TUNER1. The 5 V supply to the tuner is on pin 12.

To compensate for LNB's local oscillator frequency conversion offsets, information about the position of the signal in relation to the 27 MHz bandpass filter within the tuner passes from pin 10 of TUNER1 to pin 15 of U22. The frequency synthesised within U26 can then be varied under control of the U22. This process, known as automatic frequency control (AFC) keeps the signal central in the 27 MHz bandpass filter.

The Tuning Menu can be used to specify whether a programme is received via LNB 1 or LNB 2. Pin 6 is the select line for LNB 1 and it is enabled by Q48; pin 4 is the select line for LNB 2 and it is enabled by Q47. Power to the LNBs passes through the tuner via pin 5 for LNB 1 and pin 3 for LNB 2. The line (LNB_SELECT) which controls both the supply and select for the LNBs comes from pin 6 of U25 in the control circuitry. There are further details about the LNB supply in the SMPS circuit description on page 25.

The baseband signal from pin 13 of the tuner passes through Q49 and Q51 or Q49 and Q50 and associated components which invert the video for C-band signals. This is under the control of the line CBAND (from pin 12 of U25) which controls Q77 and occurs if the C-Band option at the Tuning Menu has been set to "Yes". The baseband signal is coupled into the audio circuitry via R559 and into the video processor U26 via R548, C184 and R311.

The baseband output from the tuner enters a pre-amplifier within U26 via pin 3. The gain of the pre-amplifier is set by R309 and R311 and the input is biased at about 2.5 V by R310 from VMID on pin 21. The pre-amplifier output on pin 2 is inverted. At this point there are two paths for the signal: one to give baseband output at pin 22 of U26 and the other to give video output at pin 6.

Baseband Amplification

MAC and PAL transmissions use different pre-emphasis. The de-emphasis required for the incoming signal format, PAL or MAC, can be selected at the Decoder Output option of the External AV Menu (a sub-menu of the Set Up Programme Menu). This PAL/MAC selection switch is within U26 (under control from U22) and is on pin 24 of U26.

If PAL is selected, the response of the amplifier is modified by the PAL de-emphasis circuit R307, C181 and C613.

If MAC is selected, the response of the amplifier is modified not only by R307, C181 and C613 but also by R308 and C182 to give MAC de-emphasis.

The signal re-enters U26 at pin 1 and passes through the baseband amplifier whose output is inverted and is on pin 22 of U26. This output is amplified by Q54, Q55, Q56 and associated components. The output then passes to pin 19 of SK3 (i.e. at the AV2 (DEC) SCART) and pin 40 of SK3 (i.e. at the AV1 (AUX) SCART)

Video Processing within U26

In the second path, the signal at pin 2 of U26 is PAL de-emphasised by the circuit R305, R306 and C180 and then re-enters U26 at pin 4. The main video amplifier re-inverts the signal which passes out of U26 at pin 6. It then goes back in at pin 7 where it forms one of the three possible video inputs to the video source selection switch. The other possible video inputs to this switch are:

- from pin 20 of SK3 (i.e. the AV2 (DEC) SCART) which enters U26 at pin 8;
- from pin 41 of SK3 (i.e. the AV1 (AUX) SCART) which enters U26 at pin 9.

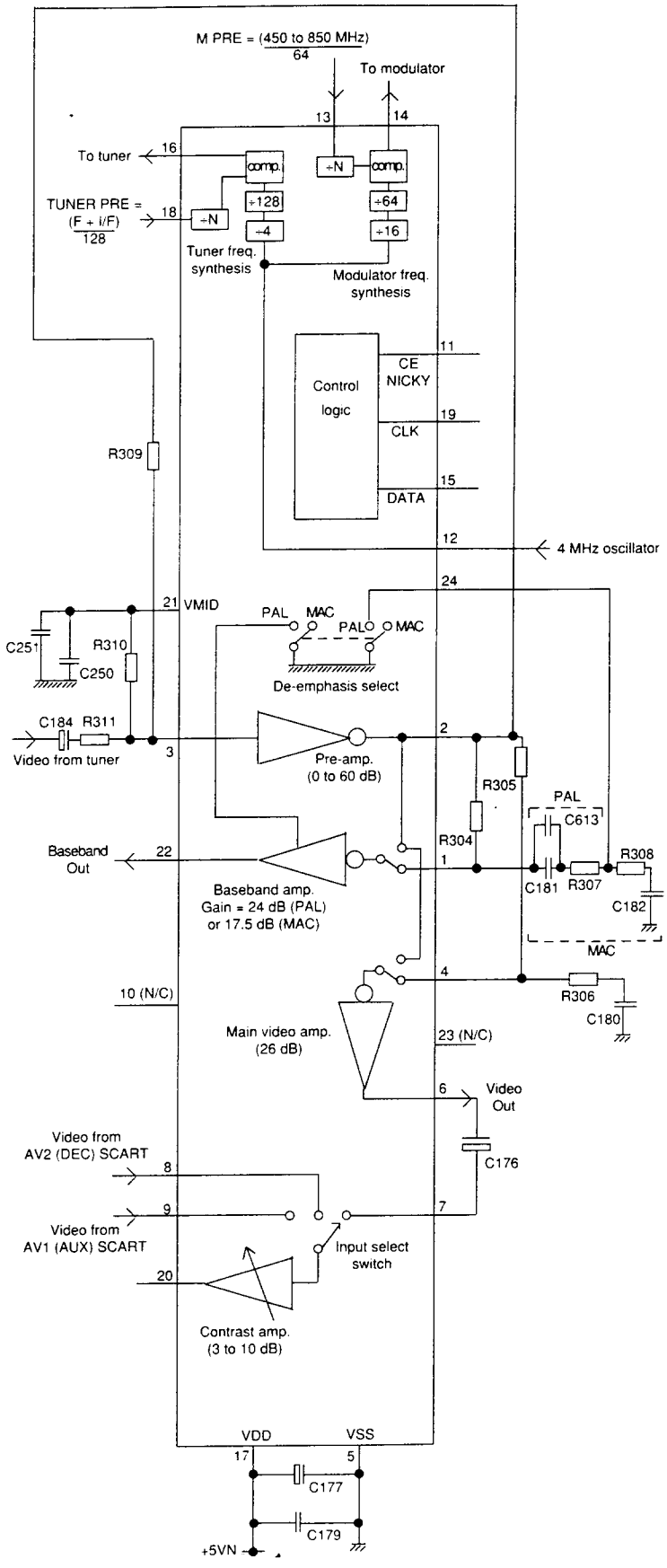
The selected video signal from this switch is then fed to a non-inverting contrast amplifier within U26 which can be varied under control from U22 (i.e. settings made at the Picture Menu). The output from this amplifier at pin 20 of U26 is then filtered.

Video Filter and Phase Compensation

After the video signal has been amplified in U26, it is coupled to a low pass filter comprising L16, L17, C583, C584, C592. C189 and C190 which has a cut-off point of 5.0 MHz. Q53 and C191 provide phase compensation.

Amplifier and Sound Trap

After being filtered and phase-compensated the video signal passes through an amplifier and sound trap (Q57, Q58, L18 and associated components) to remove any residual audio sub-carriers. It then passes to the energy dispersal clamp.



Energy Dispersal Clamp

All satellite transmissions are transmitted with energy dispersal to distribute the transmitted energy more evenly across the transmission bandwidth. Energy dispersal is a triangular 25 Hz waveform added to the signal. If this is not removed, a flickering can be seen on the screen.

To remove the energy dispersal 25 Hz triangular modulation, the video signal (which is AC coupled by C194) is sync. tip clamped by Q100 and Q99. The clamp reference is set by the signal VREF (which comes from the VideoCrypt circuitry) operating through Q98, R340 and R339 on the base of Q99. If the voltage level of the signal at the junction of L19 and C194 (i.e. test point for Oscillogram 4) is 0.6 V (or more) below the voltage level at the base of Q99, this begins to conduct. As Q99 turns on, Q100 starts to conduct thereby charging up C194 until Q99 stops conducting.

Sync. Separators

The clamped video signal passes via buffer Q62 to pin 1 of U17 and also into the VideoCrypt circuitry (see also the VideoCrypt circuit description on the separate sheet). In the VideoCrypt circuitry it is buffered by Q64 and AC coupled by C207 into pin 19 of U29, the sync. separator. (Note that U29 is part of the VideoCrypt chip set, but is shown on the main circuit diagram.) U29 has a phase locked loop with a free-running VCO which uses the ceramic resonator X5; if not locked, this will generate free-running horizontal and vertical sync. pulses.

If a valid video signal is detected at pin 19 of U29 the following happen:

- the horizontal and vertical sync. pulses are locked to the video;
- the STATION_ID line emerging at pin 7 of U29 goes high to 12 V (subsequently divided down to 5 V by R746 and R39) to show that the receiver has locked onto a signal (this line also controls other functions in the video circuitry - see the descriptions which follow).

The horizontal and vertical sync. pulses (on pins 12 and 15 respectively of U29) are needed for the VideoCrypt functions and are also fed to pins 30 and 31 respectively of U7, the colour graphics generator (see below).

At U17 non-scrambled signals are switched through from pin 1 to pin 15, whereas descrambled signals emerging from the VideoCrypt circuitry are switched through from pin 2 to pin 15 of U17. This switching at pins 1 and 2 of U17 is under the control of the main microprocessor U22 and is described in detail in the VideoCrypt circuit description on the separate sheet.

As an aid to troubleshooting you can put the receiver into a test mode which forces all the signals to pass through the VideoCrypt path. To do this, put the Main Menu on the screen, then press the following keys in quick succession: 0 then STORE then ▲ then ▼. To exit this mode you must power down the receiver. (Note: do not confuse the key strokes required for this test mode with those needed for a global reset, which are similar, but use ► and ◄ instead of ▲ and ▼ - see page 15 for more about global reset.)

The selected video at pin 15 of U17 passes through emitter follower Q101, is AC coupled by C200 and R348 and fed to buffer Q63. The video signal is diode clamped to approx. 3 V by D48, and then passes to pin 40 of SK2 (i.e. the video output at the VCR SCART). The video signal to the VCR is fed off at this point so that any on-screen graphics generated in the satellite receiver are not recorded.

The video signal at the emitter of Q63 is also divided by 2 (resistors R349 and R420) and buffered by Q105 to enter the colour graphics generator U7 at pin 13.

Colour Graphics Generator

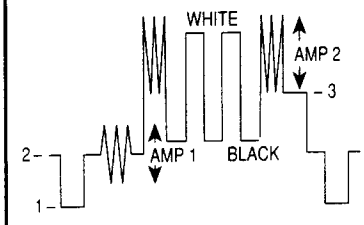
This is U7 and associated components and it is used to generate the menu background colour and on-screen text characters, under control from the microprocessor U22. There is a choice of eight menu background colours, chosen at the Picture Menu. There are two graphics modes: plain background and superimposed on a programme.

There are two oscillators associated with U7. The first oscillator is the crystal X4 which generates a frequency of 17.734 MHz. This is exactly 4 times the frequency of the colour information which is used to generate the background colour(s) and is therefore relevant to plain background mode. If this frequency is

not within a few hundred hertz of 17.7344 MHz, there may be no colour to the on-screen graphics display (it depends on the tolerance of the TV set). The second oscillator is within U7 and it runs at approximately 7 MHz, its frequency being set by external components L15, C174 and C175. This is used, together with horizontal and vertical sync. pulses, to generate the character positions on the screen. For the superimposed mode the horizontal and vertical sync. pulses come from U29 and enter U7 at pins 30 and 31 respectively. For plain background mode the horizontal and vertical sync. pulses are generated within U7.

For both modes, the black and white levels for the characters are generated by the resistor chain R294, R292, R291 and R293 on pin 14 for black and pin 15 for white.

For a TV screen showing graphics on a plain background, one line of the video signal looks like the adjacent figure. The various levels shown and the amplitude of the bursts are determined by the components associated with specific pins of U7. A table of these pins is given below the figure.



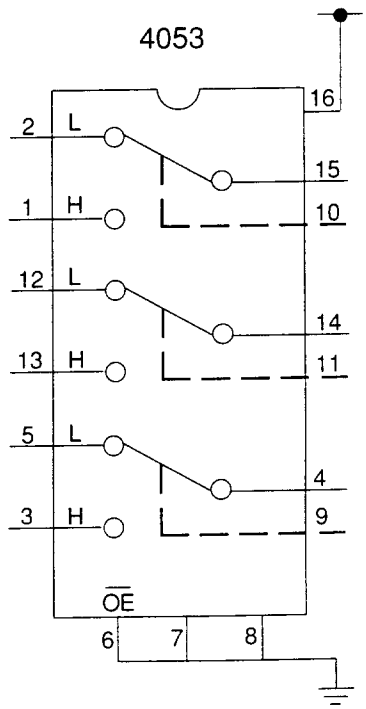
Parameter	Pin
Level 1	9
Level 2	16
Level 3	17
Black level	14
White level	15
Amplitude 1	20
Amplitude 2	19

The video signal which enters U7 at pin 13 therefore emerges at pin 12 with any superimposed graphics such as menus, programme status information etc.

U7 also generates a composite sync. output on pin 27. This output is used to put sync. pulses onto the noise which is present when there is no valid video signal. These sync. pulses are needed in order to insert graphics onto noise; pin 23 of U7 is the graphics output for this purpose.

On-screen Graphics without a Valid Video Signal

This is provided by U32 and associated components. U32 is a 4053 switch whose control lines (and the switch positions when these lines are high or low) are shown right.



When the STATION_ID line from pin 7 of U29 is high, pin 10 of U32 switches the video signal at pin 1 of U32 (which has come from pin 12 of U7) to pin 15 of U32 and from there to the modulator or TV SCART via buffer Q107.

The STATION_ID line also goes to pin 33 of the main microprocessor U22. Generally, if the line is low, U22 sends a message to U7 via the data bus to switch in a plain coloured screen with the words "NO SIGNAL" on it. However, if you have pressed "F, STORE" (see page 14), this plain screen is cancelled and you can see the noise on the screen. If the STATION_ID line is high, U22 generally commands U7 to superimpose graphics onto a picture for the Tuning Menu (and similar menus). However, if you have pressed the TV/SAT key while the menu is displayed, U22 commands U7 to insert a plain coloured background instead of the picture (see also page 14).

The signal (labelled OFF 3 in the circuit diagram) which goes to pin 13 of U7 also goes to pin 5 of U32. The signal path through U32 (via pins 4, 13, and 14) is only relevant for noise (i.e. when the STATION_ID line is low), as only in this case is the signal (noise) switched through from pin 2 to emerge at pin 15.

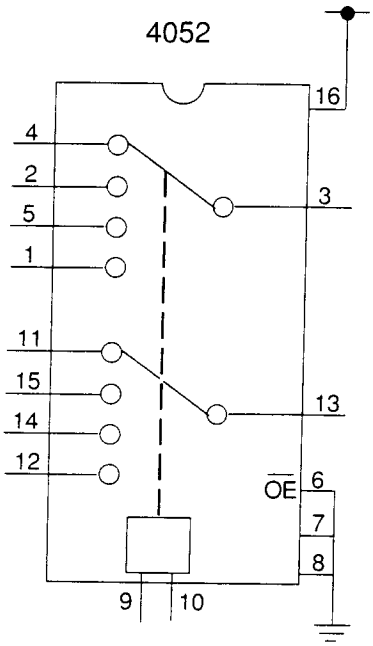
When the STATION_ID line is low, transistor Q78 switches off. This allows pin 11 of U32 to go high and low with the compsync. signal (which comes from pin 27 of U7). When it is high, the noise signal entering U32 at pin 13 passes through to pin 14. When it is low (i.e. during the sync. pulse period) pin 12 connects with pin 14 so the sync. pulse itself emerges at pin 14, its DC level being set by R444, R445 and C263. In this way the sync. pulses are added to the noise signal, which is a prerequisite for graphics insertion onto the noise signal.

The insertion of on-screen graphics onto the noise signal is controlled by the CHAR line from pin 23 of U7 which goes to pin 9 of U32. When this line is low, the noise signal entering at pin 5 of U32 passes through to emerge at pin 4. When this line is high, pin 3 connects with pin 4 to set the white level of the character to the voltage determined by R442 and R443.

Audio/Video Source Selection and SVHS Chroma Switch

The video output from pin 15 of U32 is buffered by Q107 and passes to pin 4 of U21 which is not only the video source selection switch, but also the SVHS chroma switch. Pin 3 of U21 is the video output to the TV SCART, whereas pin 13 is the SVHS chroma output to the TV SCART (and also red for RGB).

U21 is a 4052 switch; a diagram is given right. It is controlled by both lines at pins 9 and 10, so a truth table is given below the diagram to show how connections made within the switch are controlled by the status of these lines.



pin 9	pin 10	connections
high	high	3 to 4, 13 to 11
high	low	3 to 2, 13 to 15
low	high	3 to 5, 13 to 14
low	low	3 to 1, 13 to 12

The voltage level at pin 4 of U21 has been fixed by the preceding circuit. The DC voltages at pins 2, 5 and 1 are set to match this by the biasing resistors R261 and R260 from a potential divider R262 and R265.

Pin 9 of U21 is the TVSTAT control line; if TVSTAT is high then pin 9 is low (because it passes through inverter/driver Q42). Pins 1 and 5 of U21 are connected together and are the video input from pin 41 of SK2 (i.e. pin 20 of the VCR SCART). The truth table shows that whenever pin 9 is low, because pins 1 and 5 of U21 are connected, the video input from the VCR is switched through U21 to pin 3 (and therefore to the TV SCART). This is independent of the status of the AV/AUDIO line on pin 10.

When the VCR is set to play ("VCR Play" is displayed on the front panel), the line VCRSTAT at pin 8 of the VCR SCART (i.e. pin 29 of SK2) goes high, which in turn commands the microprocessor U22 to set the TVSTAT line high. The TVSTAT line also goes high when the TV/SAT key is pressed until "VCR → AV" is displayed on the front panel.

The truth table shows that when pin 9 of U21 is low the following also happens: either pin 12 or pin 14 (both of which are from the VCR SCART) is connected to pin 15 of the TV SCART. As pins 12 and 14 are connected, this means that SVHS from pin 15 of the VCR (i.e. pin 36 of SK2) is always routed through U21 to the TV SCART when the VCR video signal is routed through U21. Note that pin 15 of the TV SCART is also always linked to pin 15 of the AV2 (DEC) SCART. (Note that pin 15 is for red, and also that pin 7 for blue and pin 11 for green are linked through from the AV2 (DEC) SCART to the TV SCART).

If pin 9 of U21 is high (i.e. the TVSTAT line is low), the VCR is not selected as the video source. In that case it is the status of the AV/AUDIO line at pin 10 of U21 which determines what is routed to pin 19 of the TV SCART as follows:

- if AV/AUDIO is low, then the video input at pin 20 of the TV SCART is routed through the receiver to pin 19 of the TV SCART;
- if AV/AUDIO is high, then the video signal from the satellite video circuitry is routed to the TV SCART (note that this video signal could initially have come from the satellite programme or from equipment connected at the AV1 (AUX) or AV2 (DEC) SCARTS - see the section about video processing within U26 on page 19).

In the first of these cases, the audio input at the TV SCART is routed through into the audio processor U18 and back out to the TV SCART, as the AV/AUDIO line also controls the switch U20 (see the audio circuit description on page 30 and the audio block diagram, and note also that U20 is a 4053 switch). This is logical because if you are viewing a terrestrial channel, you will also wish to hear the terrestrial audio, and, if it is routed through the receiver, home cinema effects can be applied if required. In these conditions pin 8 of the TV SCART is high.

In the second case, the audio from the AV1 (AUX) SCART is routed into U18 which controls which of the various audio sources is routed to the TV SCART - see the section on Audio Baseband Processing and Signal Routing on page 31.

When the TV/SAT key is pressed so that "TV → AV" appears on the front panel, the microprocessor U22 causes the AV/AUDIO line at pin 13 of U25 to go high, this is then inverted by Q76, so that the AV/AUDIO line is low at U21 and U20. This therefore loops the TV signal input on pin 20 back to the TV via pin 19 of the TV SCART.

RGB Disable Switch

Pins 12, 13 and 14 of U20, the RGB disable switch, are controlled in two ways.

The first control method is via pin 11 which goes low when pin 16 of the AV2 (DEC) SCART (the RGB status line) goes high (note that Q38 inverts the signal). When pin 11 is low, pin 12 is switched to pin 14 of U20, and if pin 12 is at 5 V, transistor Q113 is turned on. This in turn causes pin 16 of the TV SCART to go high so that RGB status is enabled. If pin 16 of the AV2 (DEC) SCART is low, then pin 11 of U20 goes high and pin 14 of U20 connects to pin 13 (i.e. ground), which disables RGB status at the TV SCART.

The second control method is pin 8 of the AV1 (AUX) SCART (i.e. pin 29 of SK3). If this goes high, its inversion by Q112 means that pin 12 of U20 is pulled low. This means that although the connection remains from pin 12 to pin 14 of U20, transistor Q113 does not turn on and therefore pin 16 of the TV SCART is low (i.e. the RGB status line is disabled at the TV SCART).

In practical terms, RGB from the AV2 (DEC) SCART (pins 15, 11 and 7 respectively) is always present at the TV SCART, but can only be used by the TV if the RGB status line on pin 16 goes high (for example if a video source is connected to AV2). If you wish to watch a video source attached to AV1, the RGB from AV2 must firstly be disabled, by setting pin 8 of AV1 high (which often occurs automatically when the video source at AV1 is set to play, or can be forced by pressing the 0 (AV) key until "AV1" is displayed on the receiver's front panel).

VCRSTAT Routing

The VCRSTAT line is bi-directional between D71 and the microprocessor U22. It can be an input at pin 32 to inform U22 about the status of pin 8 of the VCR SCART (pin 29 of SK2). It is also used as an output to control the status of pin 8 of the TV SCART. This can be maintained in a given state by R108, R109 and C602 while the VCRSTAT line is momentarily changed during the reading of pin 8 of the VCR SCART (i.e. pin 29 of SK2). Once U22 has been informed that pin 8 of the VCR SCART has gone high, pin 32 of U22 becomes an output for the VCRSTAT line. U22 now sets the VCRSTAT line to high in order to drive the pin 8 of the TV SCART high (which is what is needed if the VCR is playing). Diode D71 prevents the VCRSTAT line from driving pin 8 of the VCR SCART high if the VCR is not playing and also prevents pin 8 of the VCR SCART from holding the VCRSTAT line low.

Modulator Signal Selection

The video signal emerging from pin 15 of U32 not only passes to the source select U21, but also to pin 1 of U30. Pins 1, 2 and 15 of U30 are the modulator signal select switch, which is controlled by the line MOD_VID_SRC on pin 10. (Note that U30 is a 4053 switch and its other pins are used for audio signal routing - see page 32.)

The MOD_VID_SRC line comes from pin 25 of the microprocessor U22 and is generally high, which means that the video input at pin 1 is routed through to pin 15 and from there through buffer driver Q61 to the modulator.

The input at pin 2 of U30 is the VCR video signal which has come from pins 1 and 5 of video source select switch U21. This is switched through to pin 15 of U30 if the MOD_VID_SRC line is low. This only occurs when either "VCR Play" or "VCR → AV" is displayed on the front panel AND the receiver is in Speaker Configuration 2 or 4.

The switch U30 is disabled for Speaker Configuration 3 (under control from pin 4 of U18). This is done to mute the sound to the TV SCART automatically if there is a separate centre speaker. However, this would result in no video at all reaching the UHF modulator, so there is a by-pass which causes the video on pin 1 of U30 to be connected through Q116 to pin 15 of U30 and thereby to the modulator. Therefore it is important to note that if Speaker Configuration 3 is selected and the TV is connected to the receiver by a UHF lead only, then it is not possible to see video from the VCR on the TV screen (although you can hear the VCR audio at the speakers). Note also that if the TV and receiver are connected by UHF lead only that you must use the TV handset to mute the sound to the TV, it does not occur automatically as it does when there is a SCART connector. See also the audio description for the TV SCART output on page 32.

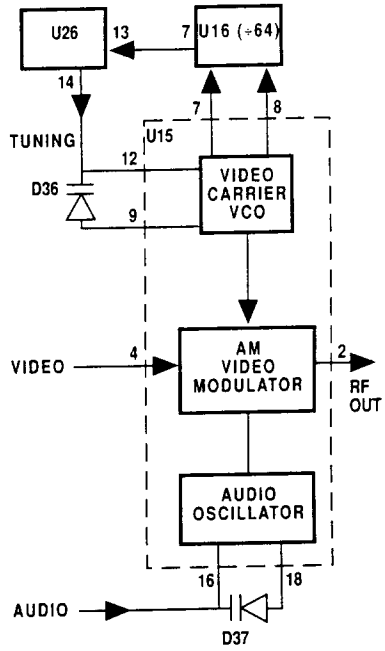
UHF MODULATOR (MAIN BOARD)

The RF output to the TV is generated by a frequency synthesised UHF modulator. This allows the RF output to be precisely tuned to any channel within the UHF bands IV and V (channels 21 - 69).

The circuitry consists of two main component parts, a loop-through amplifier between the aerial input and the output to the TV/VCR, and the UHF modulator itself, which comprises U15, U16 and associated components. The circuitry requires two power supply inputs, one to supply the amplifier (+12 V, which is always active) and one to supply the UHF modulator itself (+5 VMOD, which is powered off in standby mode).

The heart of the modulator is the IC U15, a block diagram of which is shown adjacent. It comprises the following:

- a voltage controlled oscillator that covers the full UHF band;
- an audio oscillator for the sound sub-carrier;
- an amplitude modulator to modulate the UHF carrier with the video;
- a video automatic gain control and clamp to ensure the correct modulation index.



The VCO within U15 is completed by the tuned circuit connected to pins 9,10,12 and 13 of U15.

Tuning is enabled by a DC tuning voltage in the range 0 to 24 V being applied to the varicap diode D36.

Differential outputs from pins 7 and 8 of U15 are fed to pins 3 and 2 respectively of prescaler IC U16, which divides them by 64. The output from pin 7 of U16, which should be in the range 7.1875 MHz to 13.4375 MHz, is fed into the UHF modulator's phase locked loop circuitry within U26 at pin 13 (see also the diagram of U26 on page 19).

The tuning voltage is derived from pulses on pin 14 of U26. They are integrated by Q32, Q33 and associated circuitry and eventually fed to the cathode of D36.

The audio subcarrier oscillator tuned circuit is connected across pins 15 and 16 of U15. This is set at the audio subcarrier frequency (6 MHz for PAL I; 5.5 MHz for PAL G). The audio signal from U19C is fed to the varicap diode D37 which is biased at approximately 8 V. This causes the oscillator to be frequency modulated. C126, C127, R211 and R212 (which are in the audio circuitry near U18) provide audio pre-emphasis.

The video signal (labelled OF10 in the circuit diagram) is fed into pin 4 of U15 via a video filter C96, L13 and C95. This is used to amplitude modulate the VCO output. The modulation index is set to be 80% by resistor R197 on pin 3 of U15.

The output from pin 2 of U15 is fed via a high pass filter (C71, L9 and C70) and a resistive pad (R180, R179 and R178) into a balun L8 which mixes the signal with the terrestrial video signals.

The loop-through amplifier comprises Q30 and Q31. Inputs from the terrestrial antenna pass through a resistive pad (R165, R164 and R163) and a 27 MHz high pass filter C57 and L7. Lightning protection is provided by D35. There is also further high pass filtering by C56, L6 and C55. RF and DC feedback are provided by R160. The output of gain stage Q30 is then fed through another resistive pad (R166, R167 and R168) to give good reverse isolation. RF and DC feedback for Q31 are provided by R169. The output from Q31 feeds the balun L8 and passes to the TV via the rear panel UHF connector. This balun prevents the remodulated satellite signals being sent to the aerial input and thereby being broadcast. Note that a high level terrestrial signal input (e.g. if an aerial amplifier is used) can attenuate the satellite signal output.

SWITCH MODE POWER SUPPLY (MAIN BOARD)

Mains Input and Rectification

Diodes D1, D2, D3 and D4 rectify the AC mains voltage and, together with smoothing capacitor C2, provide the DC input HT for the SMPS. C1 and T1 form a mains filter to minimise the feedback of RFI into the mains supply. Asymmetrical mains pollution is reduced by the insertion of R40 and C21 between the primary ground and the secondary chassis ground. These components are needed to satisfy the mains isolation requirements and are safety-critical components (as are SK1, FS1, T3 and U2). These components (and R1 which limits the surge current on power-up) must only be replaced by components of the correct type (see parts lists).

SMPS Controller U1

The start-up supply for U1 is obtained via R5, R367 and R804 which charge C6 to approximately 16 V before U1 will power up. C6 sustains a charge long enough for the switch mode to reach its operating frequency. The supply for U1 is subsequently 12 V and is obtained from a feedback winding of the transformer T3, rectified by D8. The frequency of the switch mode is set by R369 and C4 and should be 25 to 30 kHz. D5 and D55 provide surge protection for U1.

The secondary supplies are regulated by sampling the +5 V. This sample is provided by R429, R13 and R12 and is fed to the control pin of a variable voltage Zener diode D9. This control voltage is 2.4 V under normal conditions and can be measured at the junction of R12 and R13. The voltage on the cathode of D9 varies, thereby controlling the current through the LED within U2. This in turn varies the conduction of the internal transistor in U2.

A reference voltage of 5 V is available at pin 8 of U1. This is applied to pin 5 of U2, the collector of its internal transistor. The emitter voltage at pin 4 of U2, which varies with the conduction of the transistor, is applied via a potential divider, R3 and R4, to pin 2 of U1. This is the input of a comparator within U1 which controls the "on" time of Q1, thereby regulating the secondary supplies. R2 and C270 control the feedback loop gain of the comparator.

Excess energy from the switching of Q1 is dissipated in a snubber network R7, D6 and C7. The voltage on Q1 is limited by R110, D72 and C295. Overcurrent protection is implemented by R9, R710, R711 and R594.

Secondary Windings of T3

The secondary windings of the transformer T3 provide the following: +5 V (pin 3), +12 V unregulated (pin 5), +20 V (pin 6), -21 V (pin 7), +30 V (pin 8) and +33 V (pin 1). The LNB supply is derived from the +20 V or +12 V unregulated supply, depending on the polarisation. The +12 V supply is obtained from the +12 V unregulated supply using REG1. The +27 V tuning voltage is derived from the +30 V supply using D18. The +8 V supply on pin 39 of U18 is derived from the +12 V supply using D38 (this +8 V supply also goes to the sound board via PL4). The -8 V supply is derived from the -21 V supply using D62 and R645 (below U18 on the circuit diagram). The +33 V supply goes to the sound board to supply the power amplifiers there; the path is via PL38 on the main board, but on some receivers (see ECO S000498) it is via the alternative connector PL5.

LNB Supply Switching

Q4 in association with U3B acts as a voltage regulator for the LNB supply; R26 and Q5 provide current limiting for it. The LNB supply can be switched off by Q72 under the control of the line LNB_ON/OFF from pin 4 of U25 and occurs if there is an LNB short (see below). The status of the line LNB_ON/OFF is also determined by the setting made at the "LNB Power" option at the LNB Menu in combination with the setting at the "LNB" option at the Tuning Menu (i.e. the LNB_SELECT line). This is shown in the following truth table, where "On" also indicates that an LNB supply voltage is present at the junction of R269 and R270 (near the tuner).

	"LNB" setting in Tuning Menu	
"LNB Power" setting in LNB Menu	1	2
None	Off	Off
1	On	Off
2	Off	On
1 or 2	On	On

If the "LNB Power" option is set to "1 or 2" then the LNB supply is always present at the junction of R269 and R270. It is directed to the receiving LNB under the control of the LNB_SELECT line, the switching being carried out by Q44 for LNB 1 and Q43 for LNB 2.

LNB Short-Circuit Detection

U3A acts as a comparator to detect a short-circuit condition and indicates a short if the LNB voltage drops below 8 V. When this occurs the LNB_SHORT line informs the main microprocessor U22 which switches off the LNB supply via the LNB_ON/OFF line and also causes the message !!WARNING!! LNB SHORT to be displayed on the TV screen. Thereafter, the software keeps switching the LNB power on for half a second and off for a whole second to check whether the short-circuit is still present.

Polarisation Switching

The setting of horizontal (H) or vertical (V) polarisation at the Tuning Menu causes the control line H/V POLARITY from pin 14 of U25 to switch Q9 and Q73 in the PSU circuitry "on" or "off". If Q73 is "on" then the LNB supply is 18 V (which is required for horizontally polarised signals) and Q6 switches R37 into the reference feedback circuit on pin 2 of U3B. If switch Q73 is "off" then the LNB supply is 13 V (for vertical polarisation) and R37 is not switched in.

22 kHz Oscillator and Tone Switching

Q12 and Q13 are part of a 22 kHz oscillator which runs constantly. This is used to drive the filament of the vacuum fluorescent display on the front panel of the receiver and hence light it up. This supply line to the display is labelled FP-FILAMENT and passes via the ribbon cable between PL2 on the main PCB and PL1 on the display PCB.

The 22 kHz signal from oscillator is also used as a tone which can be added to the LNB supply via Q7 and Q11. This tone is switched to the LNB supply by Q7, which is controlled by the line TONE_ON/OFF from pin 22 of the main microprocessor U22. The status of the TONE_ON/OFF line is determined by the setting "On" or "Off" at the "Tone" option in the Tuning menu.

Power Supplies During Standby

When the receiver is put into standby, the STBY line from pin 5 of port expander U25 goes low which turns transistor Q3 off. This disables U17 by switching pin 6 high, so that all video from the satellite receiver disappears from the TV screen. If Q3 is off, then Q2 is also off which therefore means that there is no 5 V supply (+5VMOD) to the modulator itself, but the 12 V supply to the loop-through amplifier in the modulator circuitry is maintained, so that terrestrial signals can continue to be routed through the satellite receiver when it is in standby.

DISPLAY BOARD

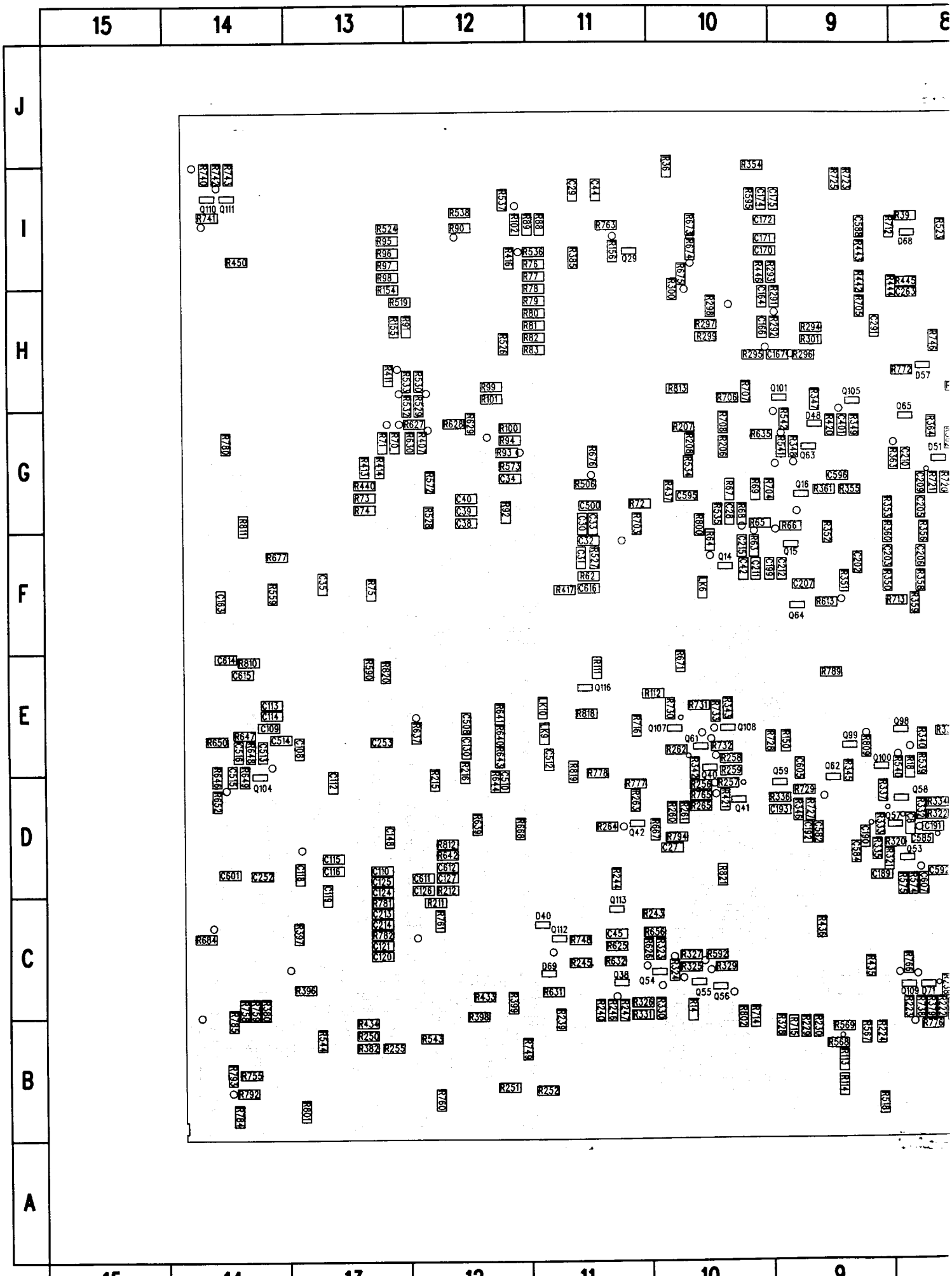
The circuit diagram for the display board is on the separate sheet at the rear of this manual. The display board comprises an infra-red sensor for the handset commands, the front panel buttons and dial, a vacuum fluorescent display (VFD1) and a microprocessor U1 which controls what appears on the VFD and also the passage of information to the microprocessor U22 on the main PCB.

When the receiver powers up, the reset line RST (from the main board) causes pin 63 of U1 to go high. The data, clock and interrupt logic are seen on pins 12, 11 and 4 respectively of U1 and these pass to the main PCB on pins 8, 7 and 6 of PL1 via a ribbon cable to PL2 on the main PCB. When the handset keys are pressed, IR data (see Oscillogram 21) is seen on pin 13 of U1. The microprocessor U1 runs at 4 MHz, determined by crystal X1.

Front Panel Switches and LEDs

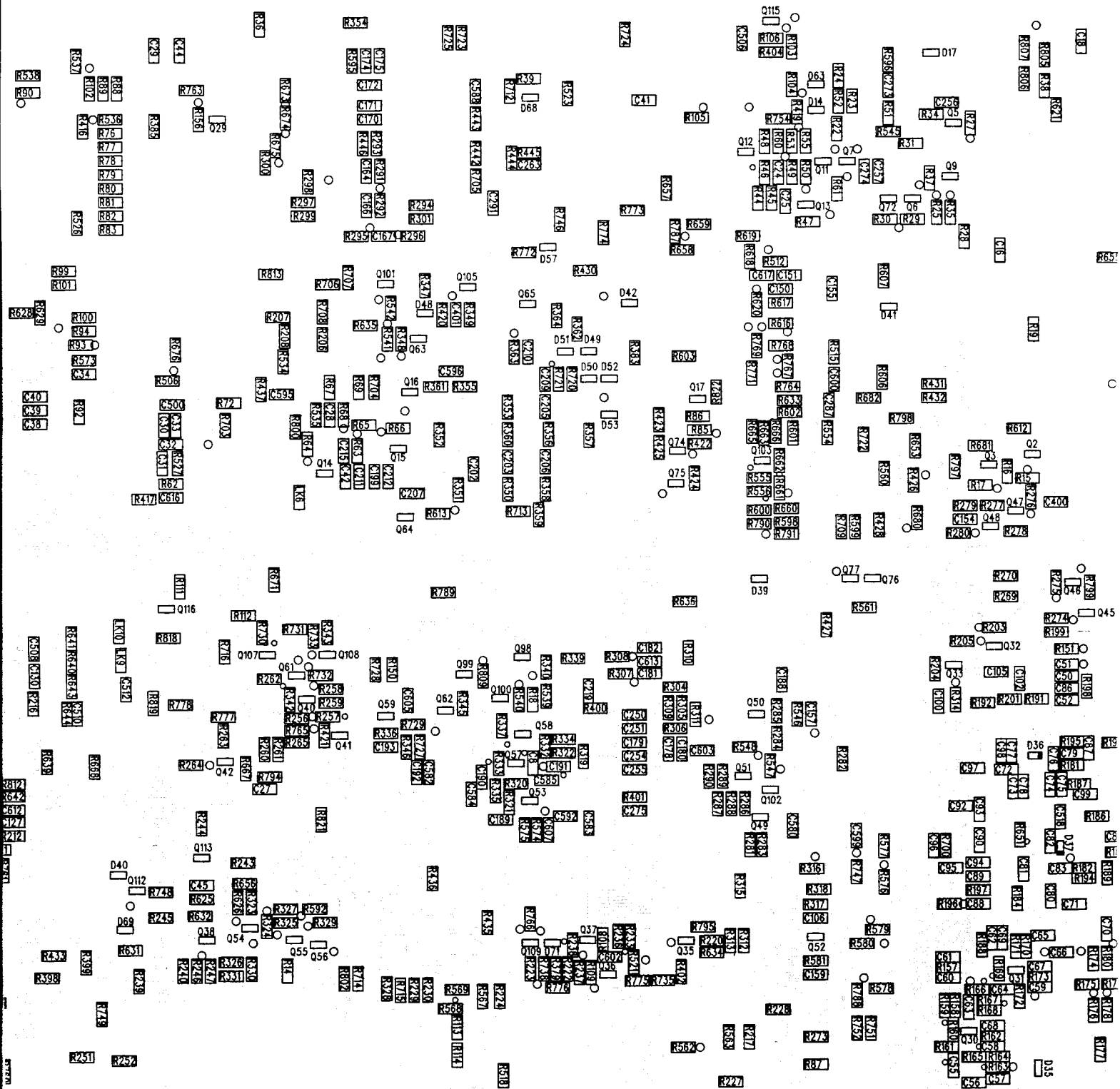
The diagram (far right) shows a simplified version of the switching circuitry. At any instant, output pins 5 and 6 of U1 can never both be high, although they will both be low when the receiver is in standby. Pin 5 being high causes LED2 (the programme selector LED) to illuminate; pin 6 being high causes LED1 (the volume LED) to illuminate. These LEDs can never be illuminated simultaneously, but will both be extinguished during standby.

MAIN BOARD IDENT DIAGRAM - SURFACE MOUNT SIDE

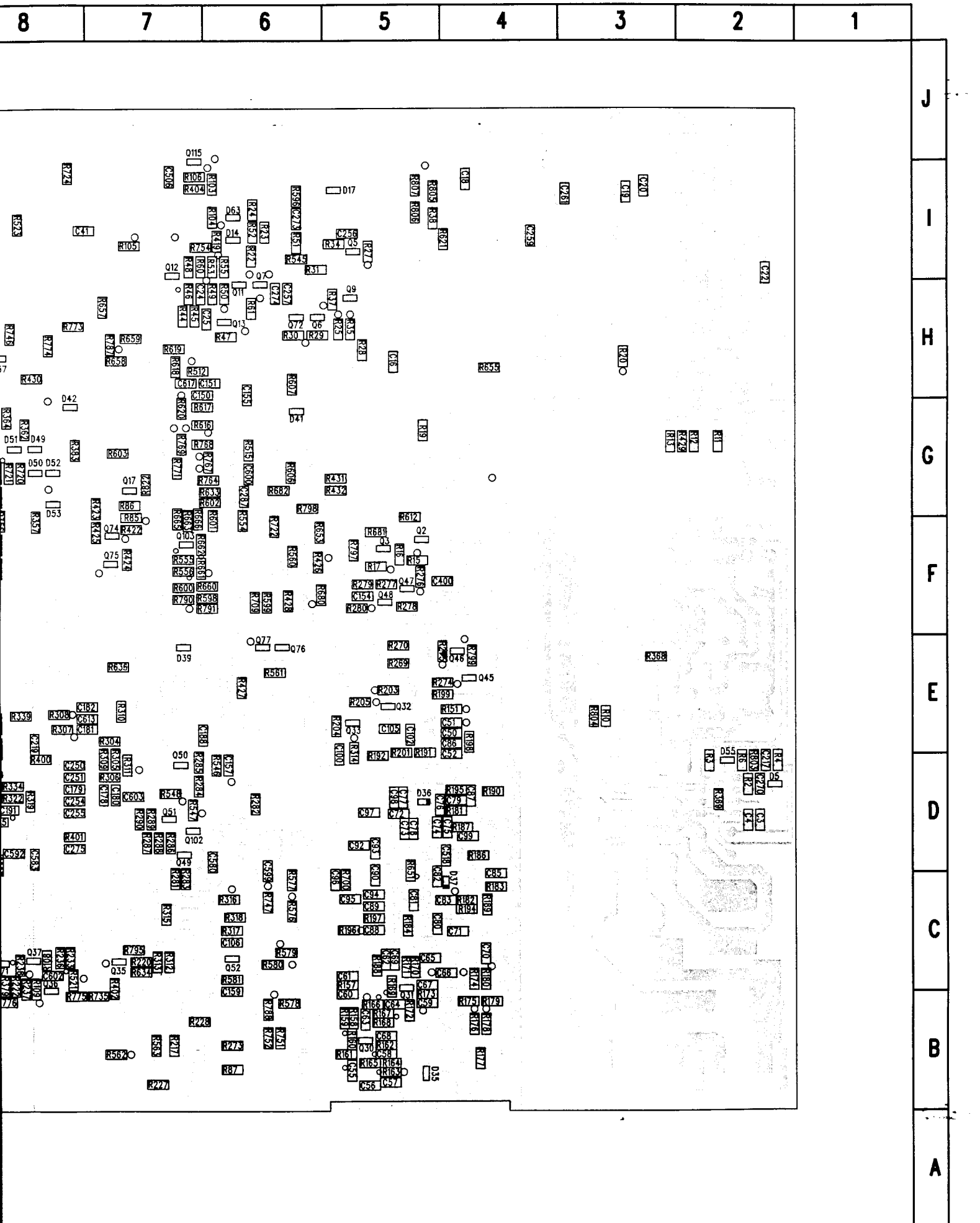


MOUNT SIDE

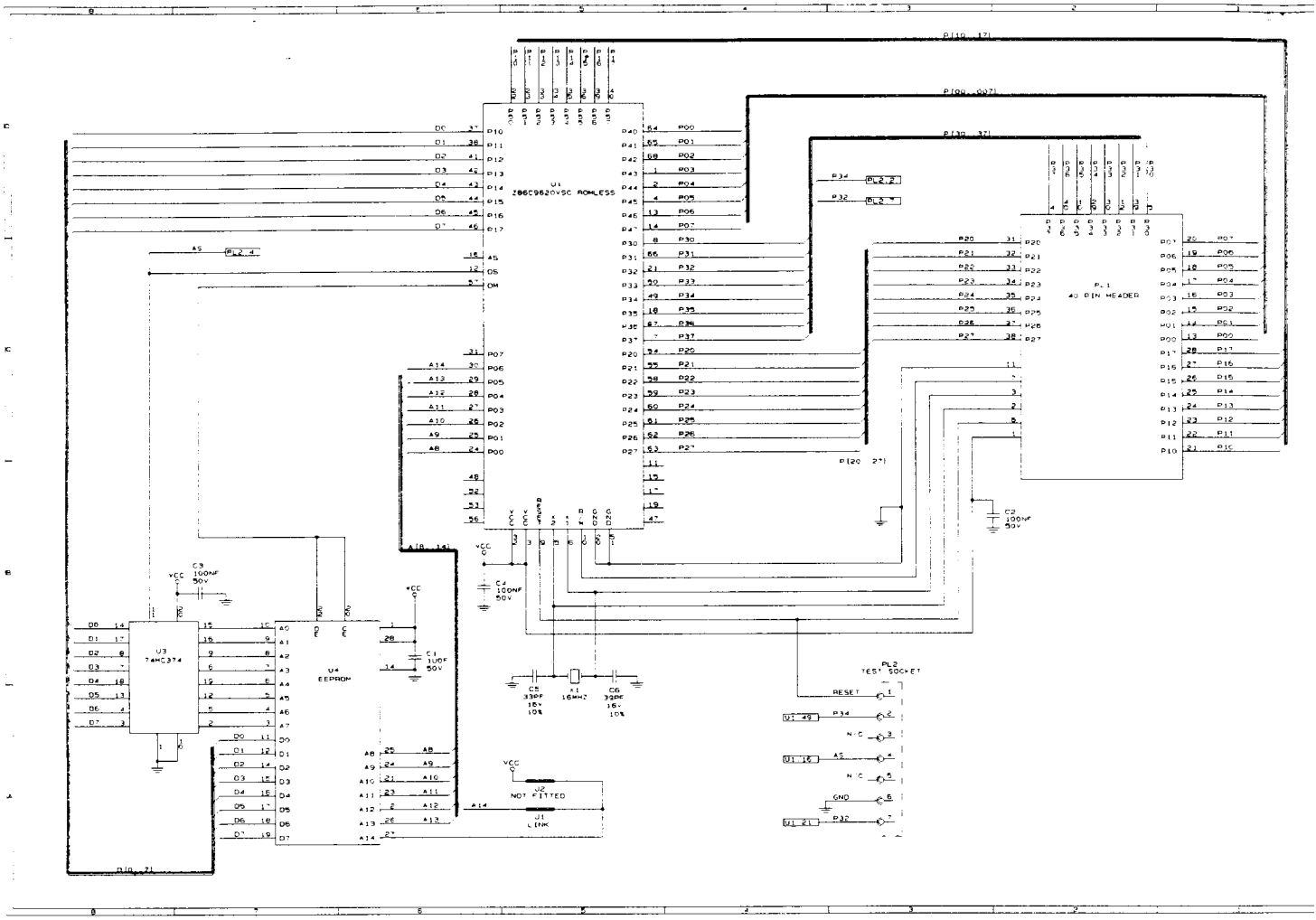
12	11	10	9	8	7	6	5	

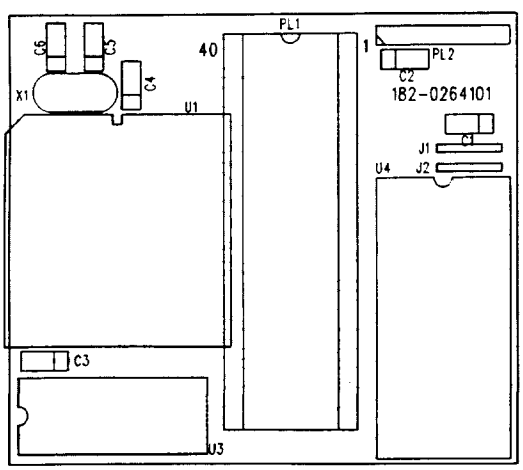


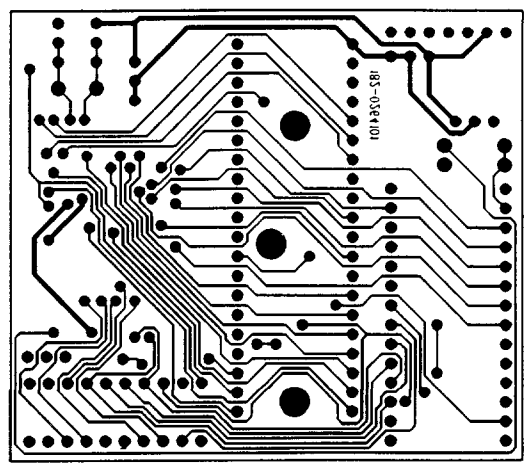
12	11	10	9	8	7	6	5	


8
7
6
5
4
3
2
1
J
I
H
G
F
E
D
C
B
A

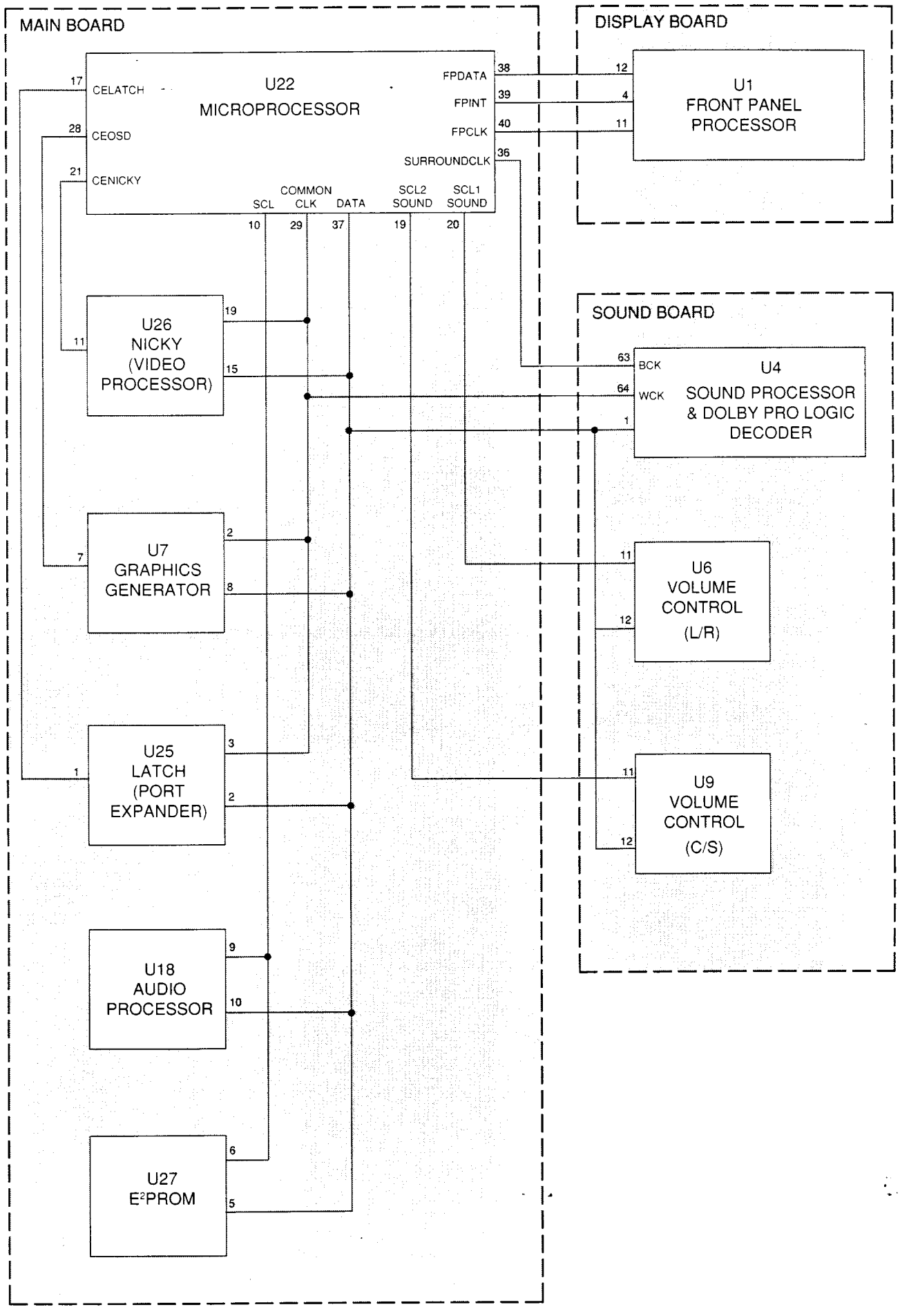
CIRCUIT AND COMPONENT IDENT DIAGRAMS FOR U22 EXTENSION PCB

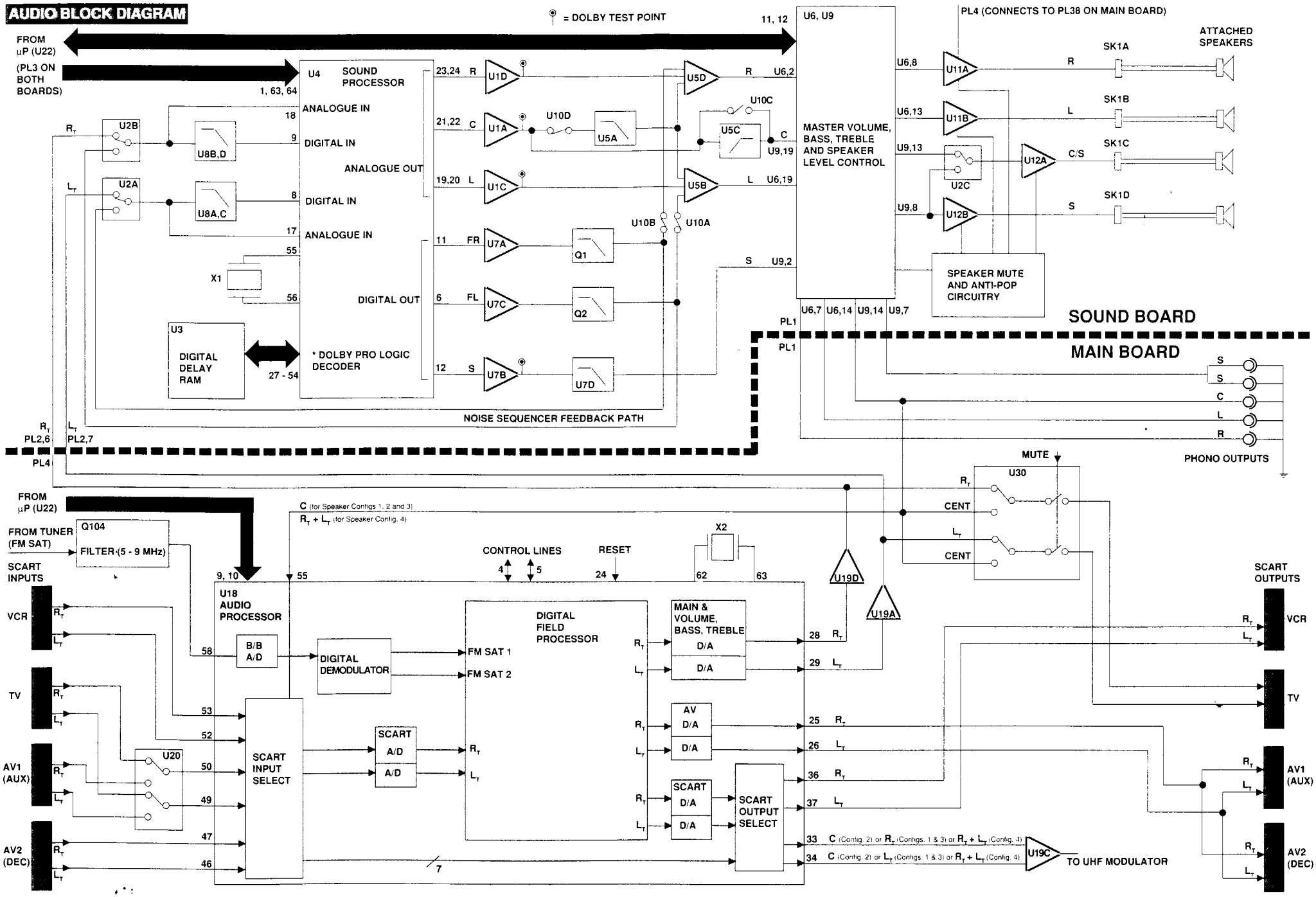






BLOCK DIAGRAM OF CLOCK AND DATA CONTROL LINES





* "Dolby", "Pro Logic" and the ◻◻ are trademarks of Dolby Laboratories Licensing Corporation. Manufactured under licence from Dolby Laboratories Licensing Corporation.

MAIN BLOCK DIAGRAM

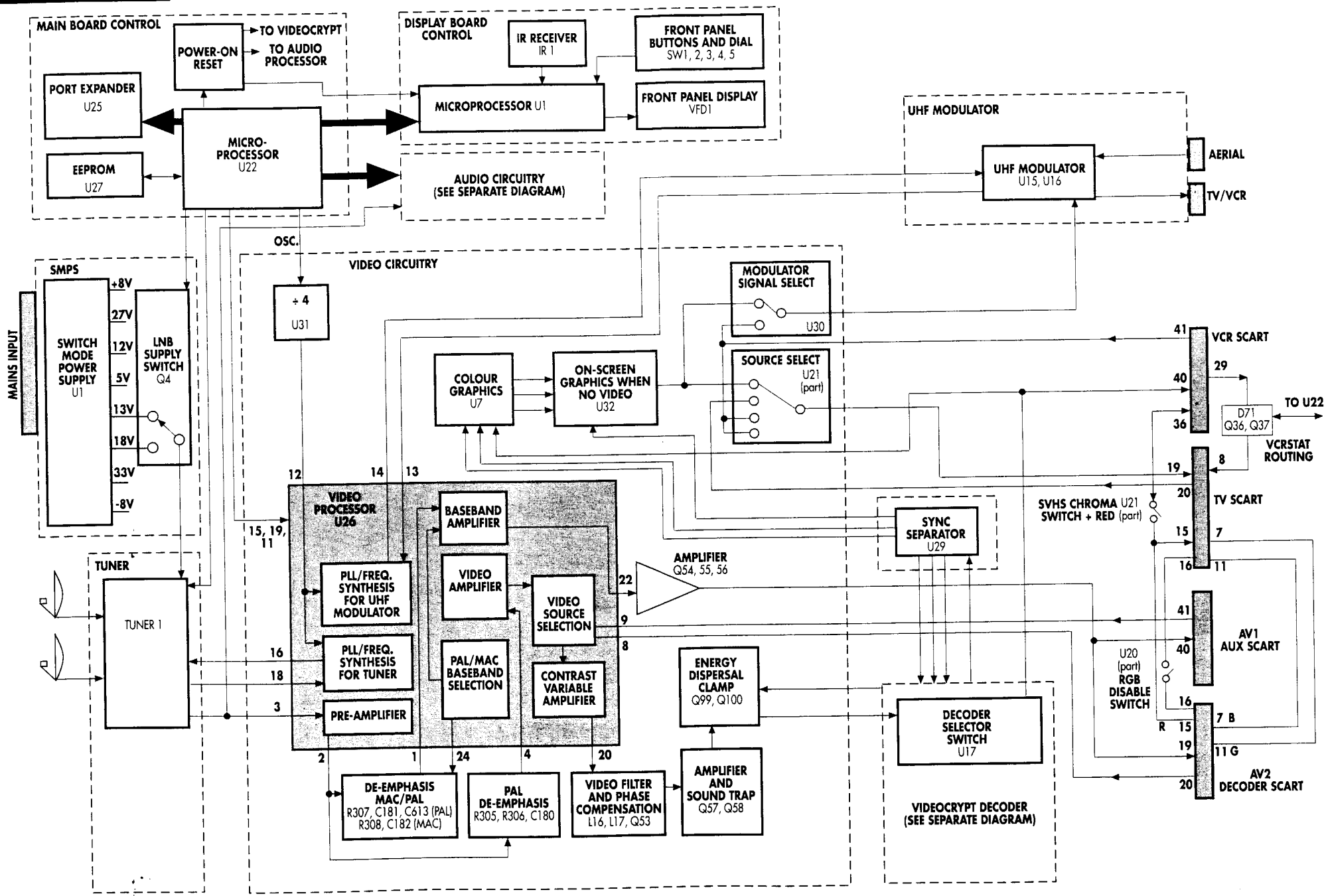
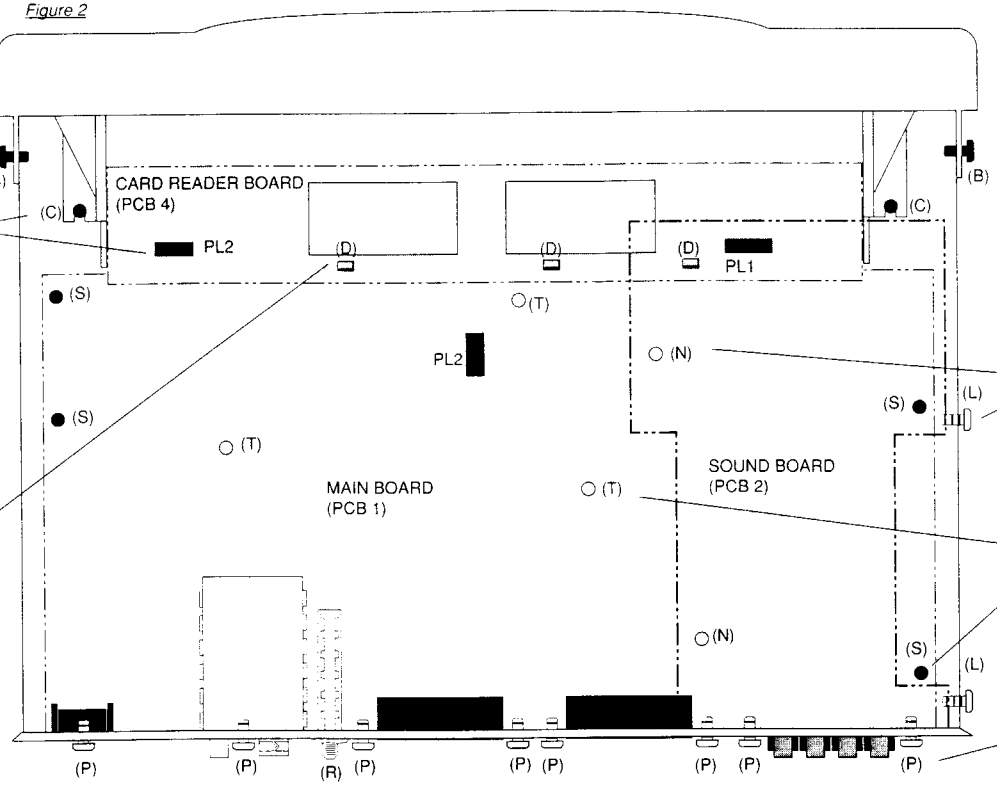


Figure 2



Removing the Front Panel (Figure 2)

Remove the ribbon cables from PL2 on the main board and PL2 on the card reader board.

Push out the push rivets (B).

Slacken the screws (C) and pull the front panel slightly away from the casing. Remove the ribbon cable at PL1.

Removing the Card Reader PCB (Figure 2)

Push back each of the 3 clips (D).

Removing the Sound PCB (Figures 1 and 2)

Remove 2 screws (L) on the side of the casing (Figure 2). Remove the 2 screws (M) (Figure 1) by the speaker connectors.

Using tweezers, crimp together the two nylon pillars (N) then pull the PCB gently away from the rear panel (to detach it completely, remove the ribbon cables and power wires which connect it to the main PCB).

To remove the insulating backing from the PCB, push out the 3 push rivets which attach it.

Removing the Main PCB (Figure 2)

Remove the 8 screws (P) and the nut (R) from the LNB connector (all on the rear panel).

Remove the 4 push rivets (S) at the edges of the main board.

While lifting the front edge of the main PCB, crimp together the stand-off prongs (T) (near the middle of the main board) using tweezers to free the PCB. Gently slide the PCB away from the rear panel.

Removing the Front-panel Dial Potentiometer (Figures 3 and 4)

Insert a very small, flat screwdriver into this space and push downwards carefully to push off the dial.

Be very careful NOT to press down on this.

Figure 3

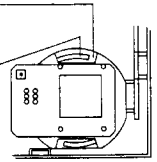
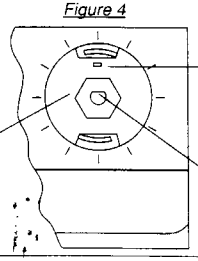


Figure 4



Use a nut runner (NOT pliers) to remove the nut and washer behind the dial.

Note on re-assembly:

There is a small, rectangular anti-rotation peg on the potentiometer which locates in a hole on the inside of the front panel.

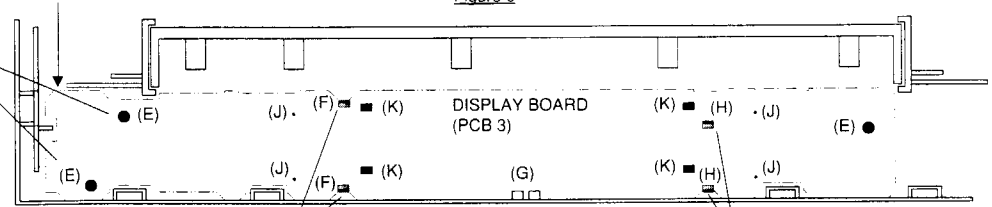
There is a "flat" on the shaft to locate the dial in the correct orientation.

Removing the Display PCB from Inside the Front Panel (Figure 5)

Start to lift the PCB gently here.

Remove the 3 screws (E).

Figure 5



Then pull back these two clips (F) and lift the PCB a little more.

Then gently pull back the top of the front panel moulding slightly to ease the PCB past this point (G).

Finally pull back these two clips (H) to free the PCB.

Note on re-assembly: Do not try to re-insert the display PCB while the potentiometer is fixed in position. There are 4 small location holes (J) which locate on posts inside the front panel moulding. Pull back the top of the moulding gently to ease the PCB past point G.

Note on removing the vacuum fluorescent display from the Display PCB: Pull back the 4 clips (K) (the pins of the display are still soldered to the PCB).

CARD READER BOARD IDENT DIAGRAMS AND ASSOCIATED GRID REFS

* = not fitted

† = component on copper (SMD) side of PCB

CAPACITORS

C1	B5†
C2	B5†
C3	C6†
C4	B9†
C5	D10
C6	B3†
C7	B2†
C8*	D10
C9	D9
C10	C5†
C11	B11†
C12	C11†
C13	C6†
C14	D8†
C15	C2†

DIODES

D1	B5†
D2	B6†
D3	B5†
D4	B6†
D5	C8†
D6	B9†
D7	C8†
D8	B8†

LINKS

J1*	B3†
J2*	B3†
J3*	C8†

CONNECTORS

PL1	C3
PL2	C11

TRANSISTORS

Q1	C11†
Q2	C4†
Q3	B11
Q4	B3
Q5	B11†
Q6	C11
Q7	C3†
Q8	B3

RESISTORS

R1	B5†
R2	B5†
R3*	B6†
R4*	C6†
R5*	B8†
R6	B3†
R7	B11†
R8	B11†
R9	B11†
R10	C11†
R11	C11†
R12	C3†
R13	C3†
R14	C3†
R15	B3†
R16*	B9†
R17	B3†
R18	C3†
R19	C6†
R20	C11†
R21	C5†
R22	C5†
R23	C5†
R24	C5†
R25	C5†
R26	C5†
R27	D8†
R28	D8†
R29	D8†
R30	D8†
R31	D8†
R32	D8†
R33	C8†
R34	C9†
R35	C9†
R36	C11†
R37	B11†
R38	B4†
R39	C3†
R40	D11

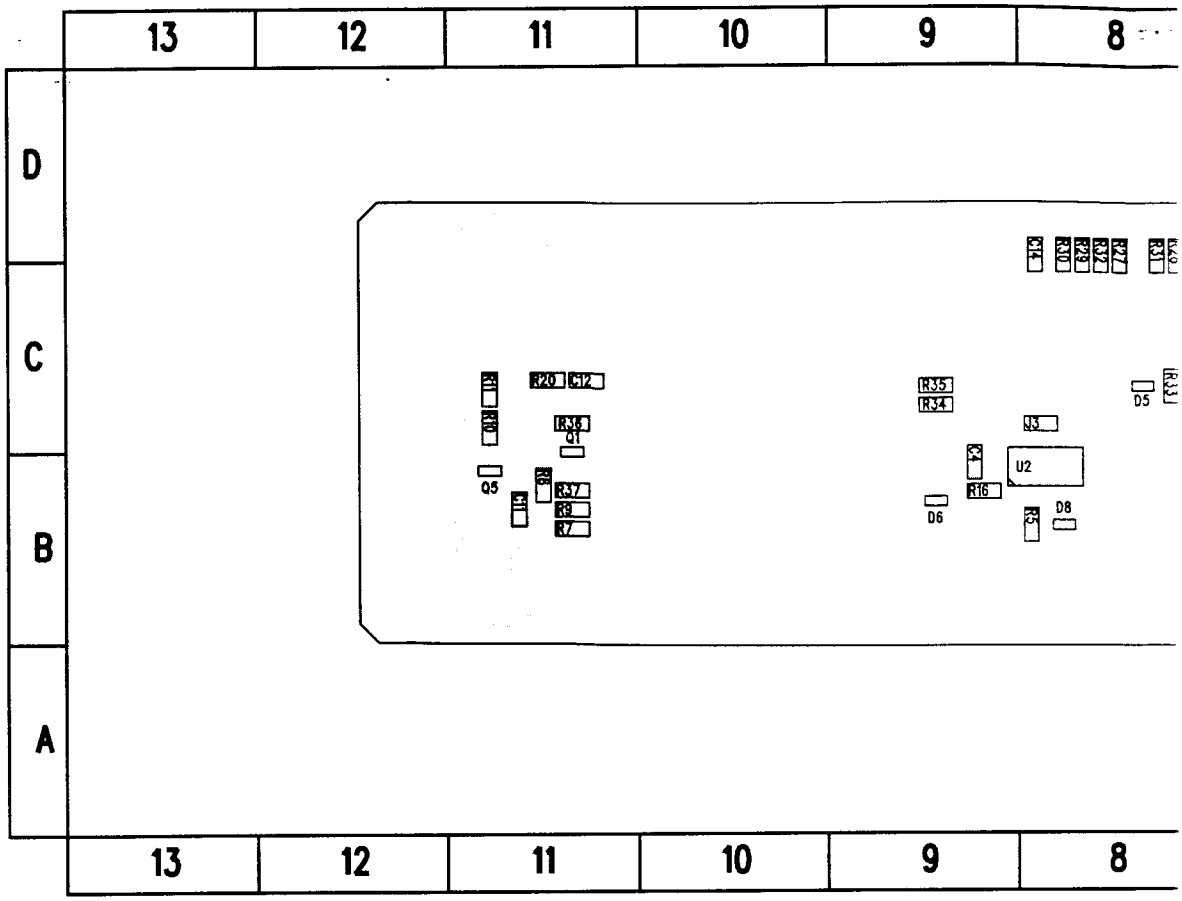
ICS

U1	C6†
U2	B8†
U3	B2
U4	C5†

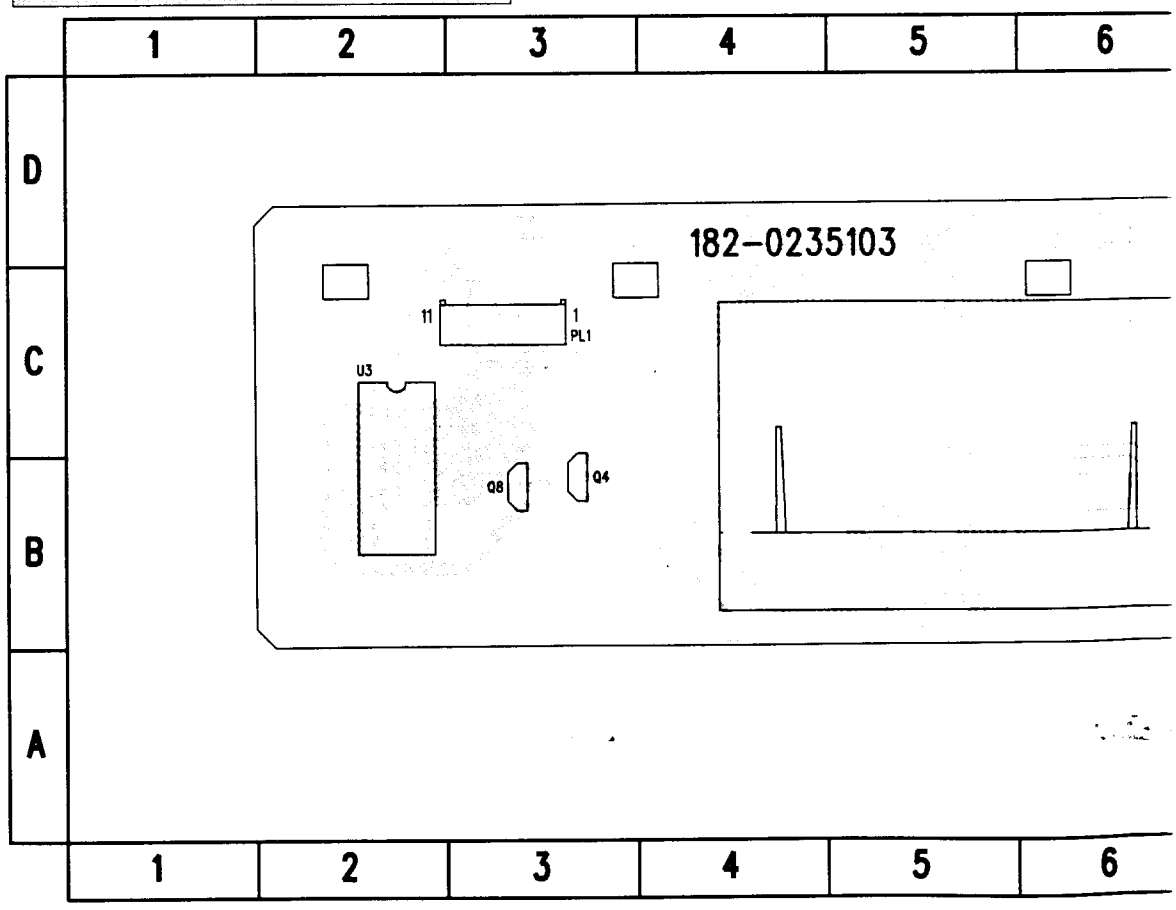
MISC. COMPONENTS

CARD1	C5
CARD2	C8

SURFACE MOUNT SIDE OF PCB

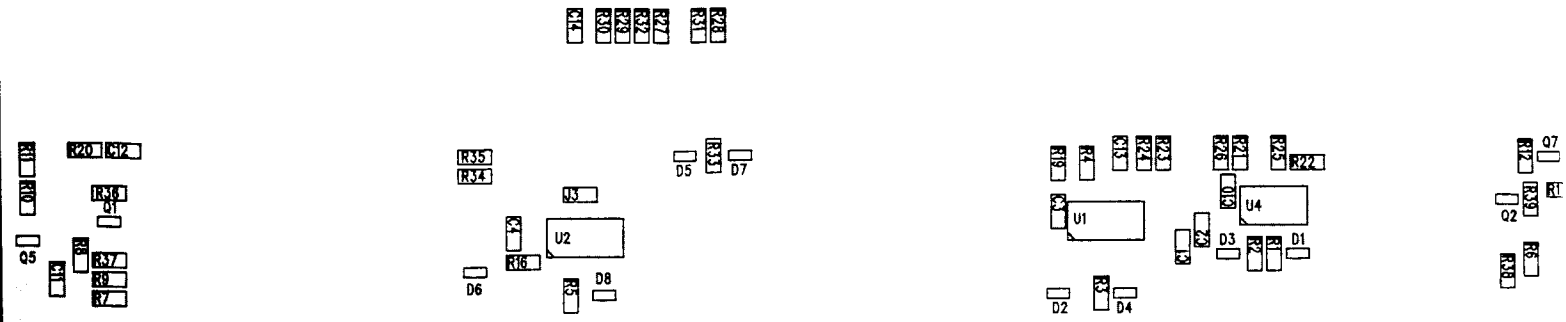


COMPONENT IDENT SIDE OF PCB



SSOCIATED GRID REFS

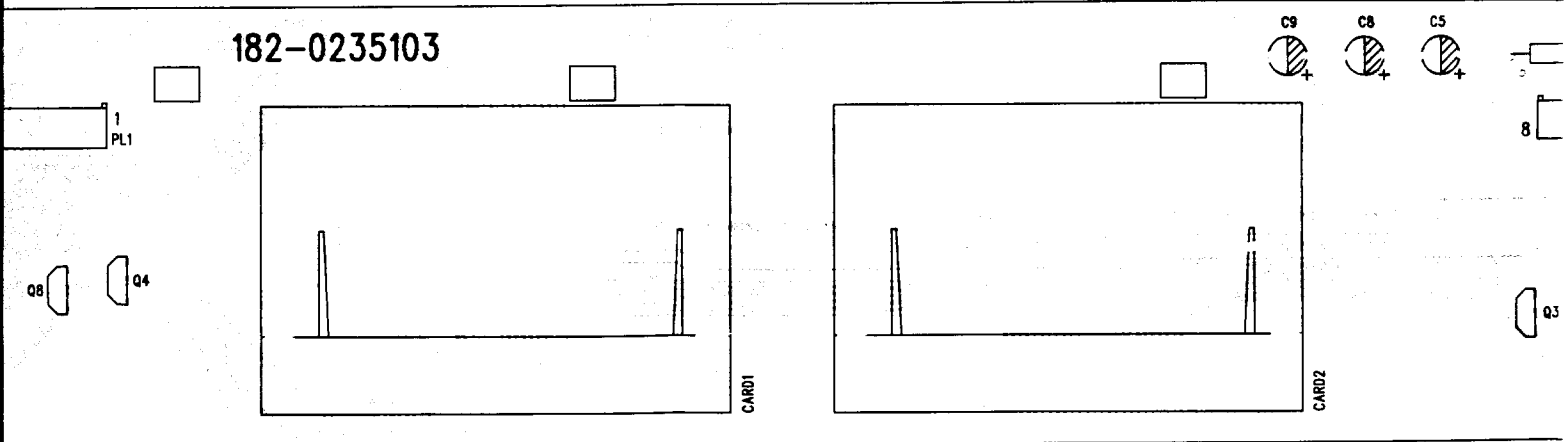
11	10	9	8	7	6	5	4



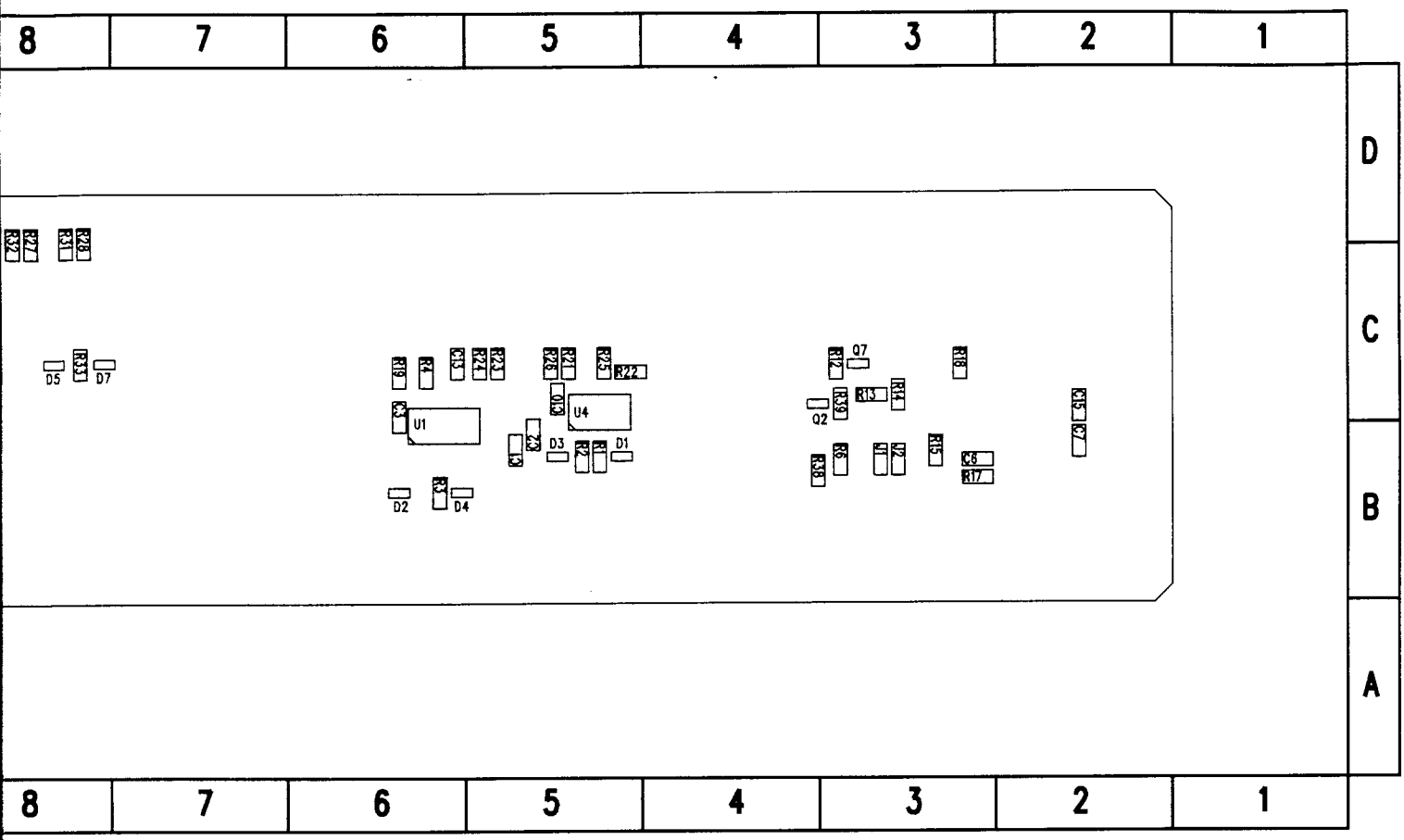
11	10	9	8	7	6	5	4

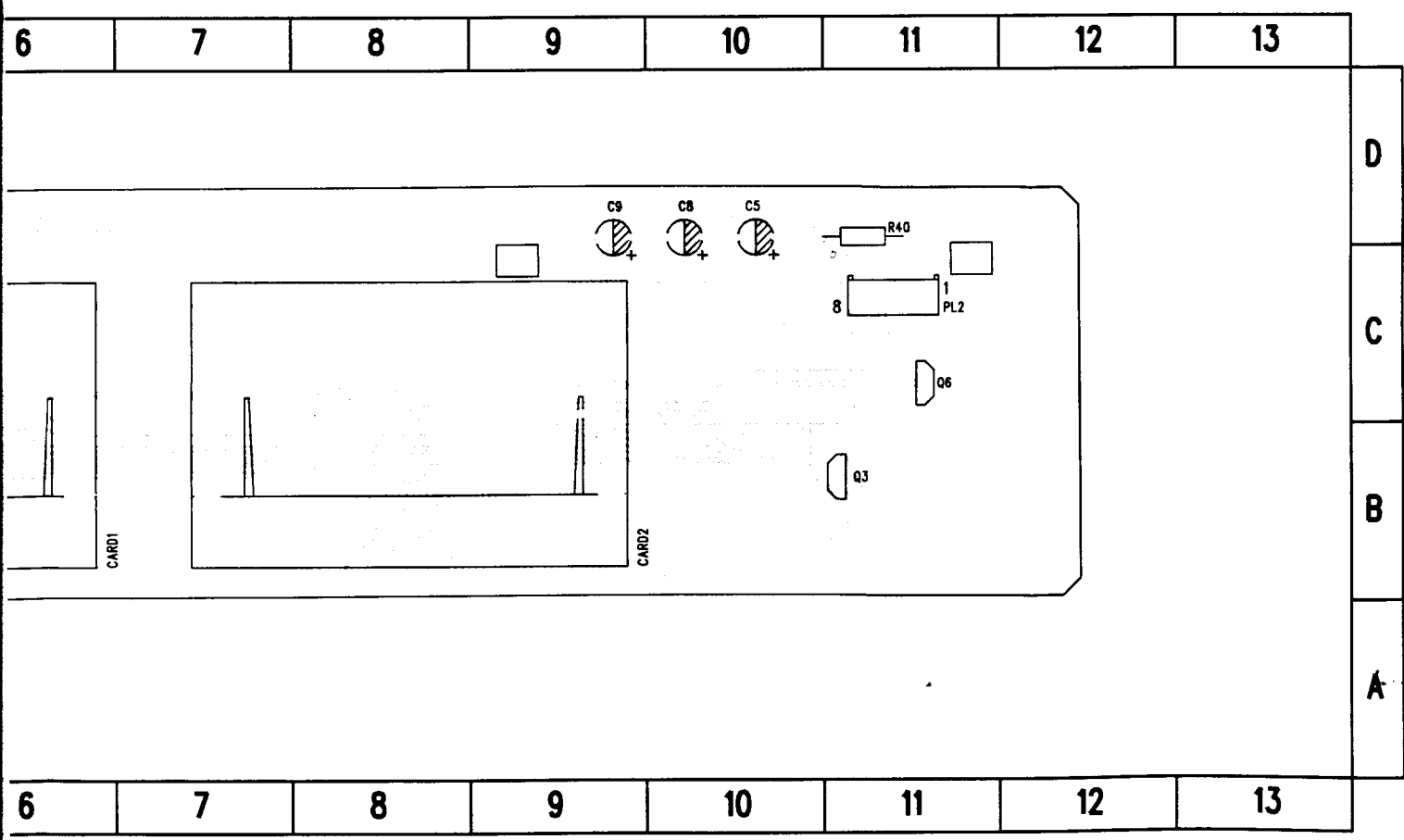
CB

3	4	5	6	7	8	9	10

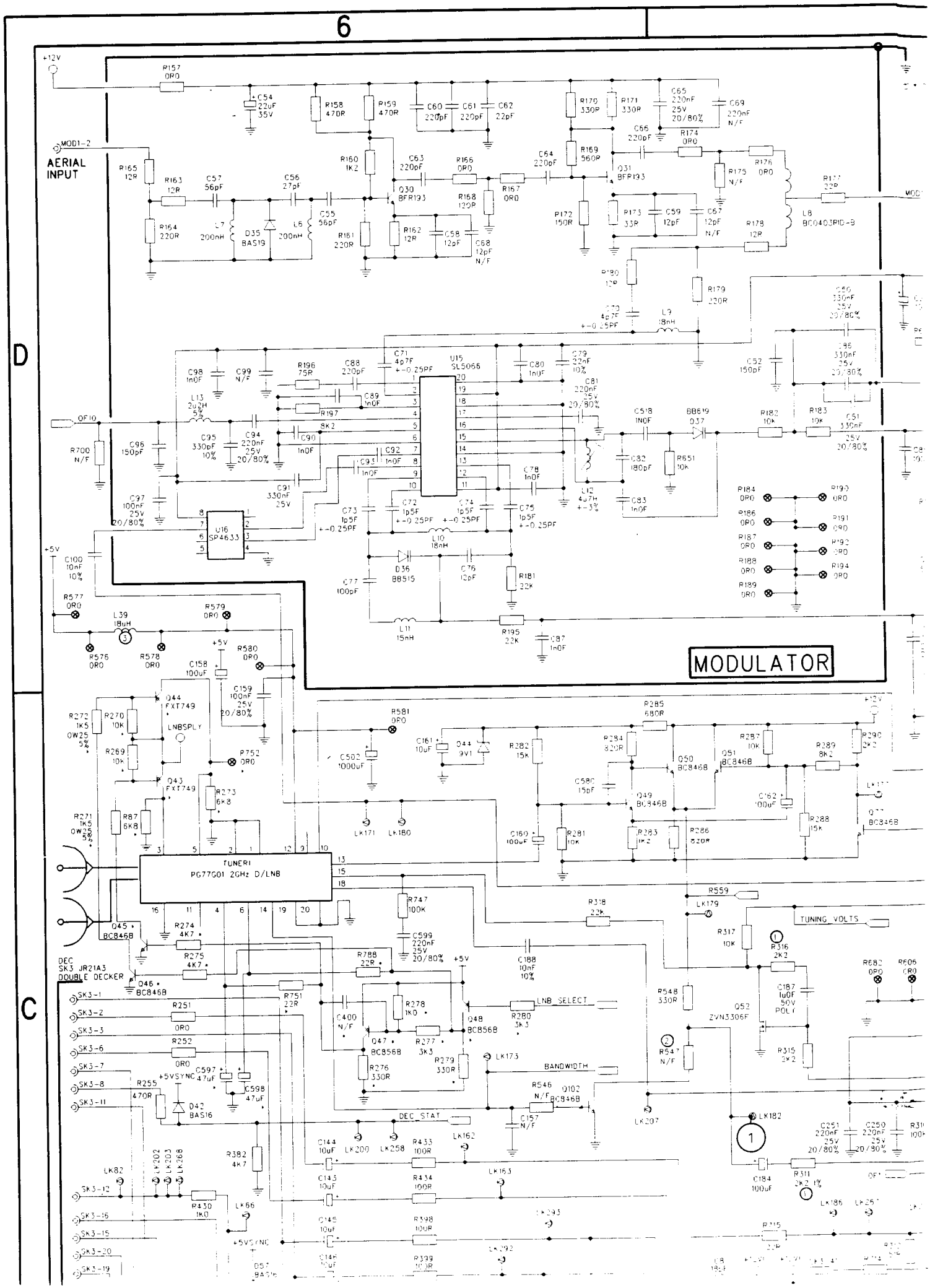


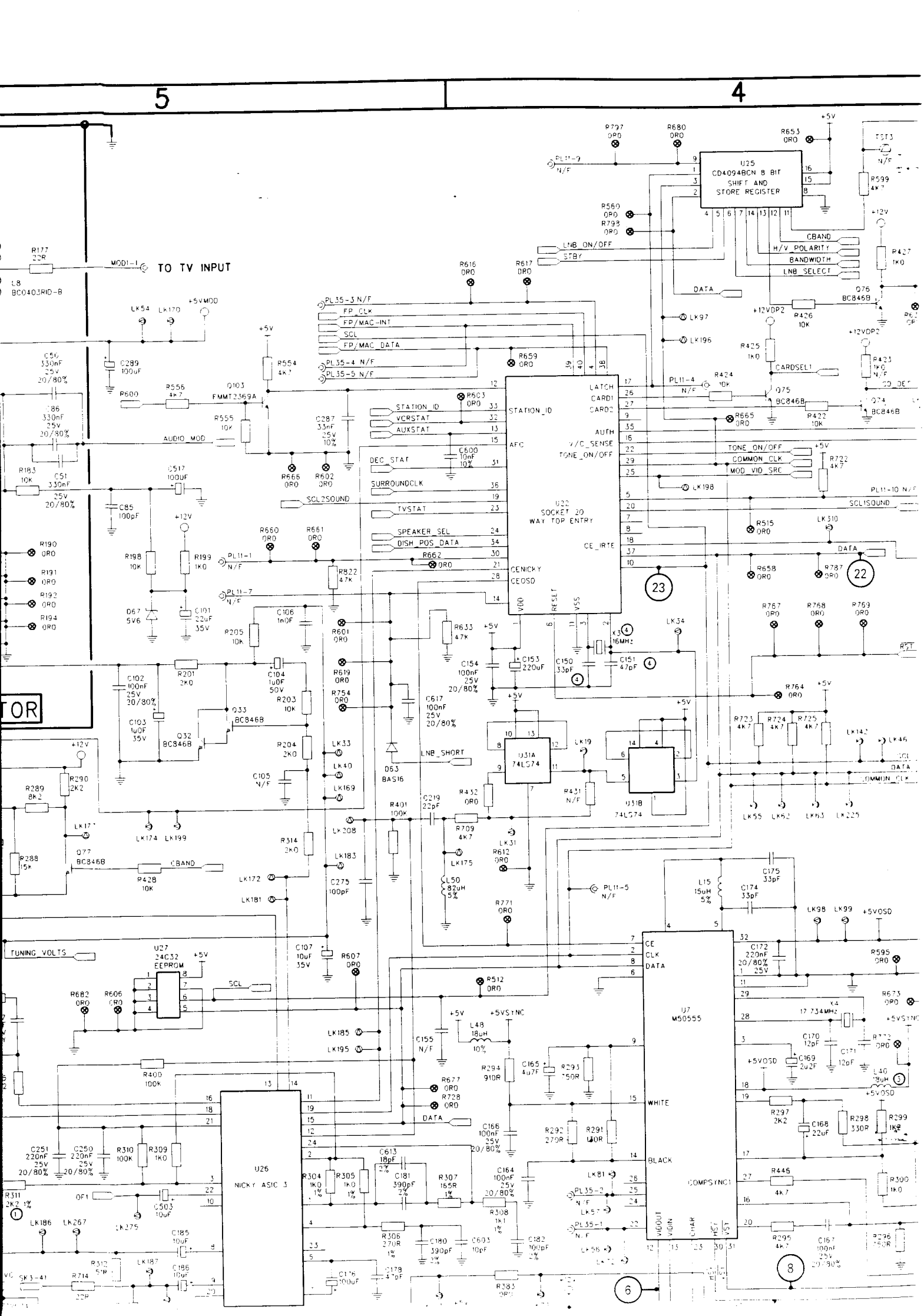
3	4	5	6	7	8	9	10

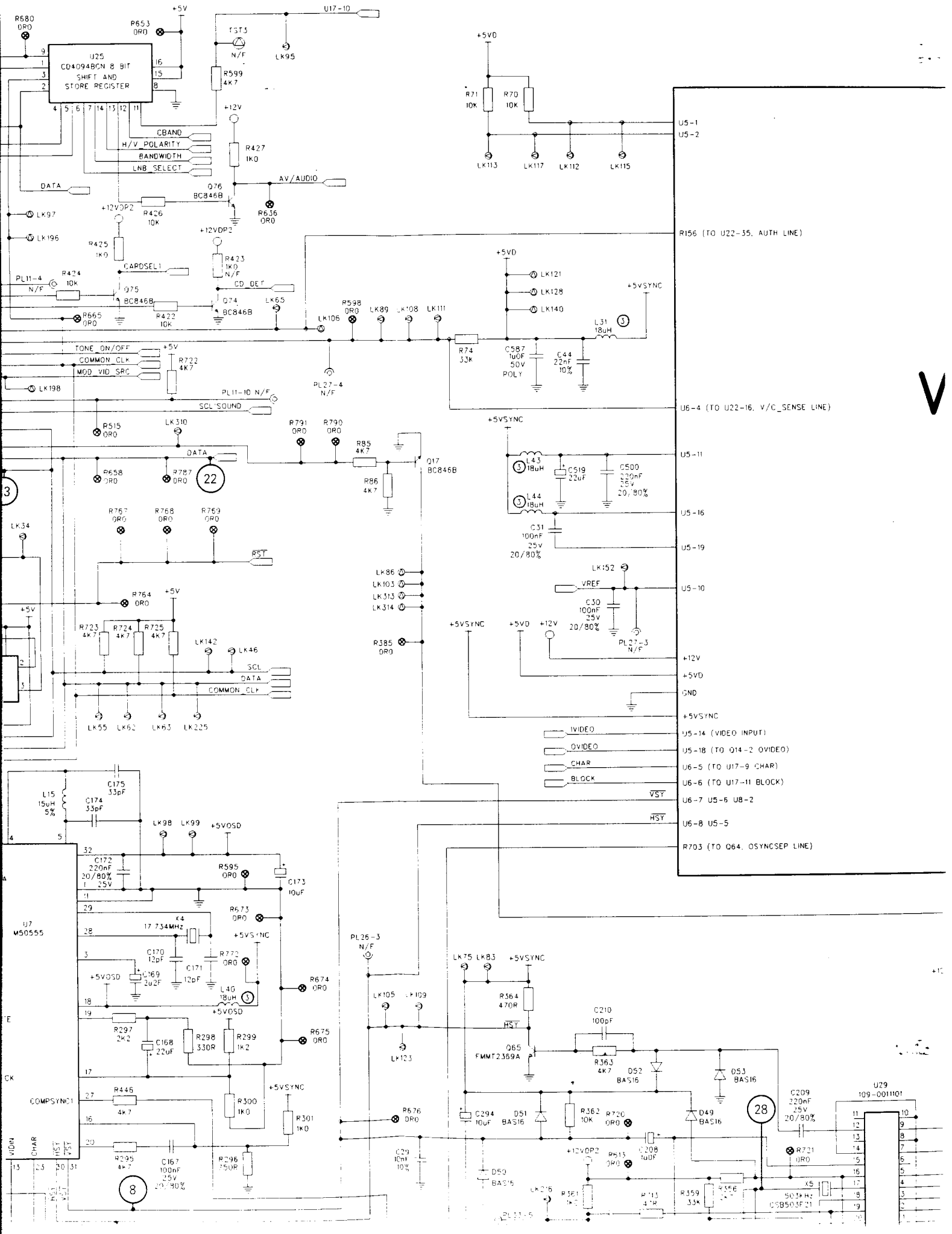

8
7
6
5
4
3
2
1
D
C
B
A
R32
R27
R31
R28
D5
R33
D7
R10
R4
R23
R24
R26
R21
R25
R22
Q3
U4
U1
C3
C2
D3
R2
R1
D1
R3
D2
D4
Q7
R12
R39
R13
R14
Q2
R18
R15
R38
R6
R5
R16
R17
R35
C7


6
7
8
9
10
11
12
13
D
C
B
A
C9
C8
C5
R40
1
8
PL2
Q6
Q3
CARD1
CARD2

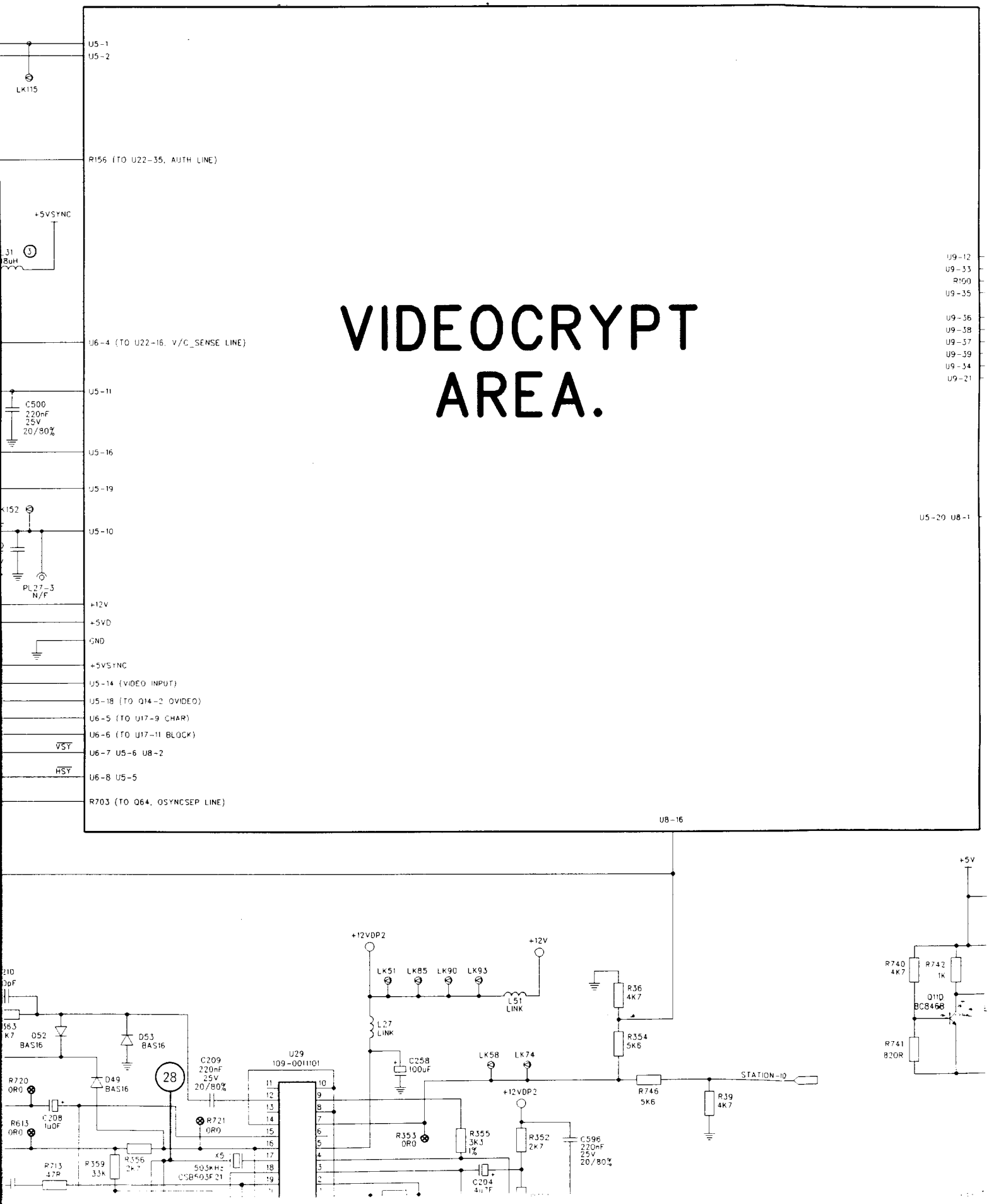
CIRCUIT DIAGRAM OF MAIN BOARD

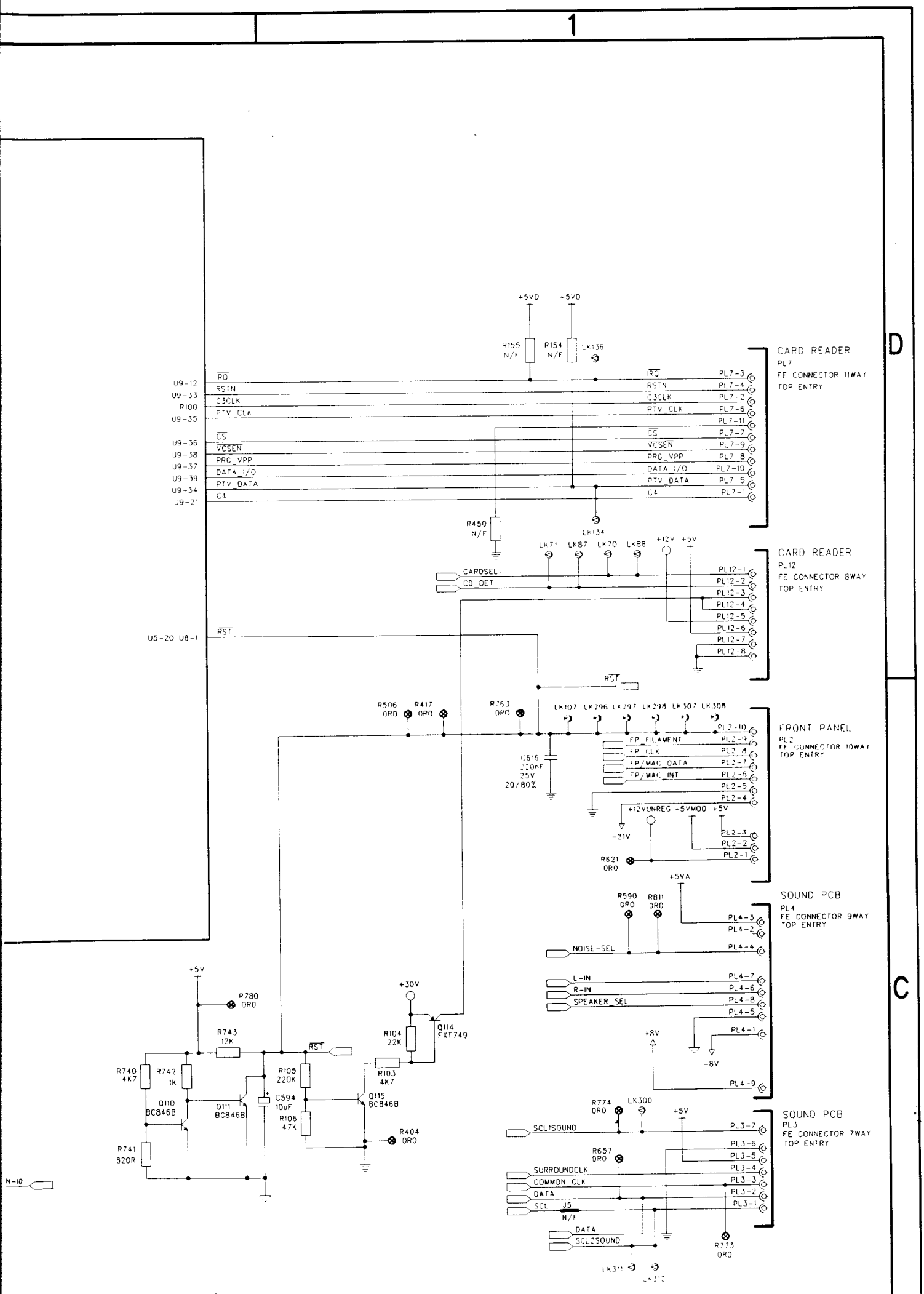


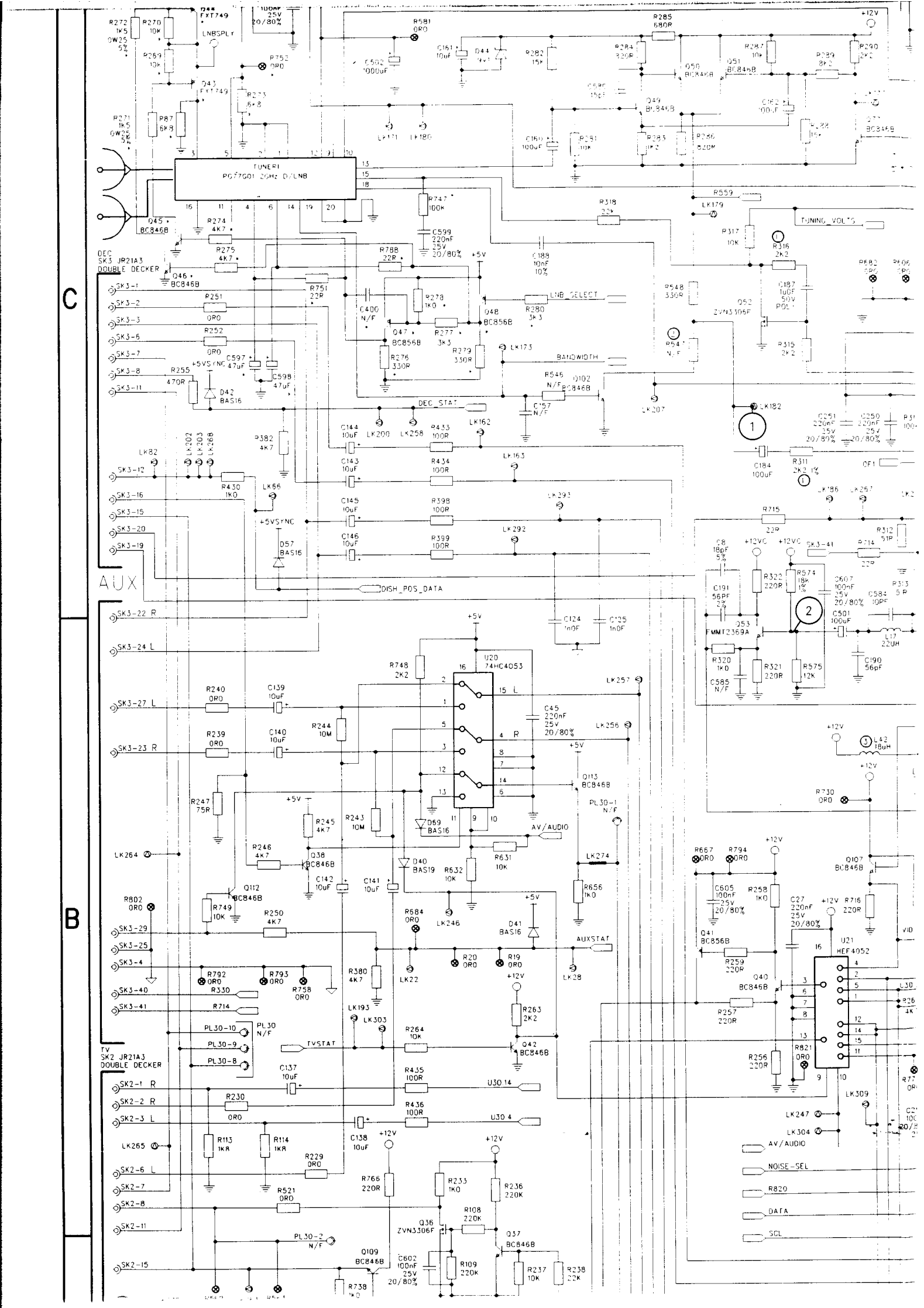

5
4
TO TV INPUT
MOD1-1
R177 22R
L8 BC0403RID-B
U25 CD4094BCN 8 BIT SHIFT AND STORE REGISTER
CBAND
H/V_POLARITY
BANDWIDTH
LNB_SELECT
LNB_ON/OFF
STBY
DATA
FP_CLK
FP/MAC-INT
SCL
FP/MAC_DATA
PL35-3 N/F
PL35-4 N/F
PL35-5 N/F
STATION_ID
VCRSTAT
AUXSTAT
DEC_STAT
SURROUNDCLK
SCL2SOUND
TVSTAT
SPEAKER_SEL
DISH_POS_DATA
U22 SOCKET 20 WAY TOP ENTRY
LATCH
CARD1
CARD2
AUTH
I²C_SENSE
TONE_ON/OFF
AFC
CE_IRTE
CENICKY
CEOSD
VDD
RESET
VSS
TONE_ON/OFF
COMMON_CLK
MOD_VID_SRC
CARDSEL1
AUDIO_MOD
LNB_SHORT
TUNING_VOLTS
U27 24C32 EEPROM
SCL
U26 NICKY ASIC 3
U7 M50555
COMPSYNC1
WHITE
BLACK
VCOUT
VCIN
CHAR
HOUT
VOUT
+5V
+12V
+5VMOD
+12VDP2
+5VOSD
+5VSYNC
X3 16MHz
X4 17.734MHz
Q103 FMMT2369A
Q32 BC846B
Q33 BC846B
Q75 BC846B
Q76 BC846B
Q77 BC846B
D67 5V6
D63 BAS16
U31A 74LS74
U31B 74LS74
22
23
8
6

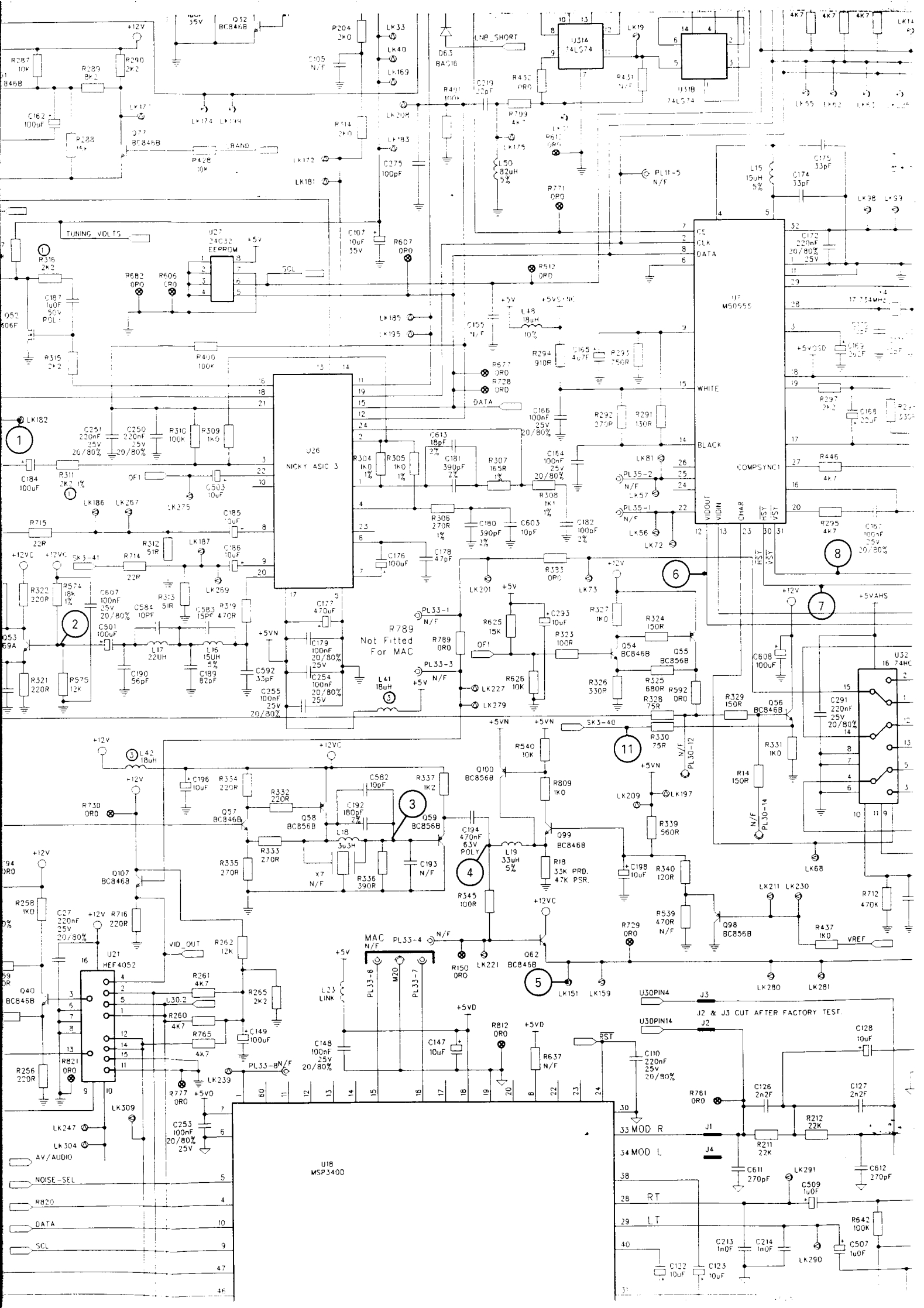

4
3
U25
CD4094BCN 8 BIT
SHIFT AND
STORE REGISTER
U7
M50555
U29
109-001101
+5V
+12V
+5VD
+5VSYNC
+5VOSD
+12VDP2
U17-10
U5-1
U5-2
U5-4 (TO U22-16, V/C_SENSE LINE)
U5-11
U5-16
U5-19
U5-10
U5-14 (VIDEO INPUT)
U5-18 (TO Q14-2 OVIDEO)
U6-5 (TO U17-9 CHAR)
U6-6 (TO U17-11 BLOCK)
U6-7 U5-6 U8-2
U6-8 U5-5
R703 (TO Q64, OSYNCSEP LINE)
R156 (TO U22-35, AUTH LINE)
GND
IVIDEO
OVIDEO
CHAR
BLOCK
VSY
HSY
DATA
SCL
COMMON_CLK
CBAND
H/V_POLARITY
BANDWIDTH
LNB_SELECT
AV/AUDIO
CARDSEL1
CD_DET
TONE_ON/OFF
COMMON_CLK
MOD_VID_SRC
SCL'SOUND
RST
COMPSYNC1
VIDIN
CHAR
HSY
VSY
R680 0R0
R653 0R0
R599 4K7
R427 1K0
R426 10K
R636 0R0
R425 1K0
R423 1K0 N/F
R424 10K
R665 0R0
R422 10K
R71 10K
R70 10K
R598 0R0
R74 33K
C587 1uOF 50V POLY
C44 22nF 10%
L31 18uH
R722 4K7
R515 0R0
R658 0R0
R787 0R0
R791 0R0
R790 0R0
R85 4K7
R86 4K7
Q17 BC846B
L43 18uH
L44 18uH
C519 22uF
C500 220nF 25V 20/80%
C31 100nF 25V 20/80%
C30 100nF 25V 20/80%
R767 0R0
R768 0R0
R769 0R0
R764 0R0
R723 4K7
R724 4K7
R725 4K7
R385 0R0
L15 15uH 5%
C175 33pF
C174 33pF
C172 220nF 20/80% 25V
C173 10uF
R595 0R0
R673 0R0
X4 17.734MHz
C170 12pF
C171 12pF
R772 0R0
C169 2u2F
L40 18uH
R674 0R0
R297 2K2
C168 22uF
R298 330R
R299 1K2
R675 0R0
R446 4K7
R300 1K0
R301 1K0
R295 4K7
C167 100nF 25V 20/80%
R296 750R
R364 470R
C210 100pF
Q65 FMMT2369A
R363 4K7
D52 BAS16
D53 BAS16
D51 BAS16
D49 BAS16
D50 BAS16
C294 10uF
R362 10K
R720 0R0
C29 10nF 10%
C208 100F
R513 0R0
R721 0R0
C209 220nF 25V 20/80%
R359 33K
R556
X5
503kHz
CSB503F21
R561 1K5
R713 47R
C215
PL27-4 N/F
PL27-3 N/F
PL11-4 N/F
PL11-10 N/F
PL26-3 N/F
LK34
LK65
LK89
LK98
LK99
LK106
LK108
LK111
LK113
LK117
LK112
LK115
LK121
LK128
LK140
LK142
LK46
LK55
LK62
LK63
LK225
LK86
LK103
LK313
LK314
LK152
LK310
LK97
LK196
LK198
LK105
LK109
LK123
LK75
LK83
LK216
Q76 BC846B
Q75 BC846B
Q74 BC846B
22
8
28

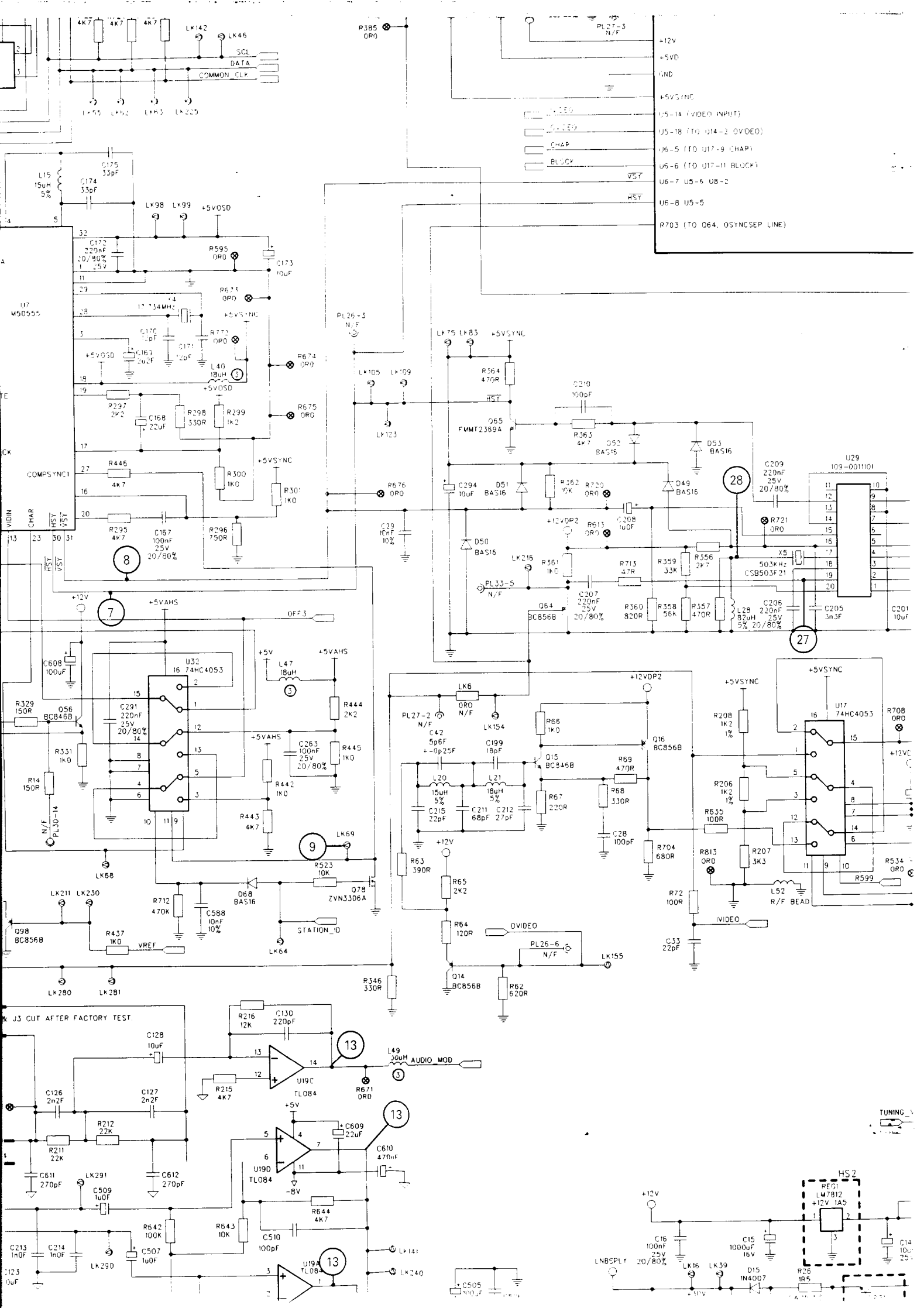
3 | 2


U5-1
U5-2
LK115
R156 (TO U22-35, AUTH LINE)
+5VSYNC
U6-4 (TO U22-16, V/C_SENSE LINE)
U5-11
C500
220nF
25V
20/80%
U5-16
U5-19
U5-10
PL27-3
N/F
+12V
+5VD
GND
+5VSYNC
U5-14 (VIDEO INPUT)
U5-18 (TO Q14-2 OVIDEO)
U6-5 (TO U17-9 CHAR)
U6-6 (TO U17-11 BLOCK)
VSY
U6-7 U5-6 U8-2
HSY
U6-8 U5-5
R703 (TO Q64, OSYNCSEP LINE)
VIDEOCRYPT
AREA.
U9-12
U9-33
R100
U9-35
U9-36
U9-38
U9-37
U9-39
U9-34
U9-21
U5-20 U8-1
U8-16
+12VDP2
+12V
LK51
LK85
LK90
LK93
L51
LINK
L27
LINK
R36
4K7
R354
5K6
LK58
LK74
C258
100uF
STATION-10
R746
5K6
R39
4K7
+12VDP2
R353
0R0
R355
3K3
1%
R352
2K7
C596
220nF
25V
20/80%
C204
4u7F
+5V
R740
4K7
R742
1K
Q110
BC846B
R741
820R
D52
BAS16
D53
BAS16
D49
BAS16
28
C209
220nF
25V
20/80%
U29
109-0011101
R720
0R0
C208
1uDF
R613
0R0
R721
0R0
R713
47R
R359
33K
R556
2K7
X5
505kHz
CSB503F21


1
D
C
+5VD
+5VD
R155 N/F
R154 N/F
LK136
CARD READER
PL7
FE CONNECTOR 11WAY TOP ENTRY
U9-12 IRQ
RSTN
U9-33 C3CLK
R100 PTV_CLK
U9-35
CS
U9-36 VCSEN
U9-38 PRG_VPP
U9-37 DATA_I/O
U9-39 PTV_DATA
U9-34 C4
U9-21
PL7-3
PL7-4
PL7-2
PL7-6
PL7-11
PL7-7
PL7-9
PL7-8
PL7-10
PL7-5
PL7-1
R450 N/F
LK134
LK71 LK87 LK70 LK88
+12V +5V
CARD READER
PL12
FE CONNECTOR 8WAY TOP ENTRY
CARDSEL1
CD_DET
PL12-1
PL12-2
PL12-3
PL12-4
PL12-5
PL12-6
PL12-7
PL12-8
U5-20 U8-1 RST
R506 0R0
R417 0R0
R763 0R0
LK107 LK296 LK297 LK298 LK307 LK308
FRONT PANEL
PL2
FE CONNECTOR 10WAY TOP ENTRY
C616 220nF 25V 20/80%
FP_FILAMENT
FP_CLK
FP/MAC_DATA
FP/MAC_INT
PL2-10
PL2-9
PL2-8
PL2-7
PL2-6
PL2-5
PL2-4
+12VUNREG +5VMOD +5V
-21V
PL2-3
PL2-2
PL2-1
R621 0R0
+5VA
R590 0R0
R811 0R0
SOUND PCB
PL4
FE CONNECTOR 9WAY TOP ENTRY
PL4-3
PL4-2
NOISE-SEL
PL4-4
L-IN
R-IN
SPEAKER_SEL
PL4-7
PL4-6
PL4-8
PL4-5
PL4-1
+8V
-8V
PL4-9
+5V
R780 0R0
R743 12K
RST
R740 4K7
R742 1K
Q110 BC846B
Q111 BC846B
R741 820R
R105 220K
C594 10uF
R106 47K
+30V
R104 22K
Q114 FXT749
R103 4K7
Q115 BC846B
R404 0R0
N-10
R774 0R0
LK300
+5V
SCLISOUND
PL3-7
R657 0R0
PL3-6
PL3-5
SURROUNDCLK
COMMON_CLK
DATA
SCL
PL3-4
PL3-3
PL3-2
PL3-1
J5 N/F
DATA
SCL2SOUND
SOUND PCB
PL3
FE CONNECTOR 7WAY TOP ENTRY
R773 0R0
LK311
LK312


TUNER1
PG77G01 2GHz D/LNB
DEC
SK3 JR21A3
DOUBLE DECKER
AUX
TV
SK2 JR21A3
DOUBLE DECKER
LNBSPLY
TUNING_VOLTS
LNB_SELECT
BANDWIDTH
DEC_STAT
DISH_POS_DATA
AV/AUDIO
TVSTAT
AUXSTAT
NOISE-SEL
R820
DATA
SCL
U20
74HC4053
U21
HEF4052
C
B


U26
NICKY ASIC 3
U7
M50555
U18
MSP3400
U21
HEF4052
U27
24C32
EEPROM
U31A
74LS74
U31B
74LS74
U32
16 74HC
TUNING_VOLTS
SCL
DATA
WHITE
BLACK
COMPSYNC1
VIDOUT
VIDIN
CHAR
HST
VST
LNB_SHORT
BAND
R789
Not Fitted
For MAC
MAC
N/F
J2 & J3 CUT AFTER FACTORY TEST.
U30PIN4
U30PIN14
MOD R
MOD L
RT
LT
AV/AUDIO
NOISE-SEL
R820
DATA
SCL
VID_OUT
VREF
+12V
+5V
+5VD
+5VN
+5VAHS
+12VC


+12V
+5VD
GND
+5VSYNC
U5-14 (VIDEO INPUT)
U5-18 (TO U14-2 OVIDEO)
U6-5 (TO U17-9 CHAR)
U6-6 (TO U17-11 BLOCK)
U6-7 U5-6 U8-2
U6-8 U5-5
R703 (TO Q64, OSYNCSEP LINE)
SCL
DATA
COMMON_CLK
+5VOSD
+5VAHS
+12VDP2
+5V
-8V
OVIDEO
IVIDEO
VREF
STATION_ID
AUDIO_MOD
TUNING_V
OFF3
U7 M50555
U29 109-0011101
U32 74HC4053
U17 74HC4053
U19A TL084
U19B TL084
U19C TL084
Q56 BC846B
Q64 BC856B
Q65 FMMT2369A
Q78 ZVN3306A
Q98 BC856B
Q14 BC856B
Q15 BC846B
Q16 BC856B
D49 BAS16
D50 BAS16
D51 BAS16
D52 BAS16
D53 BAS16
D68 BAS16
REG1 LM7812 +12V 1A5
D15 1N4007
X5 503KHz CSB503F21
L40 18uH
L47 18uH
L49 56uH
L52 R/F BEAD
L20 15uH 5%
L21 18uH 5%
COMPSYNC1
VIDIN
CHAR
HSY
VSY
LNBSPLY
PL26-3 N/F
PL27-3 N/F
PL27-2 N/F
PL33-5 N/F
PL30-14 N/F
PL26-6 N/F
J3 CUT AFTER FACTORY TEST.

+12V

+5VD

GND

+5VSYNC

U5-14 (VIDEO INPUT)

U5-18 (TO Q14-2 QVIDEO)

U6-5 (TO U17-9 CHAR)

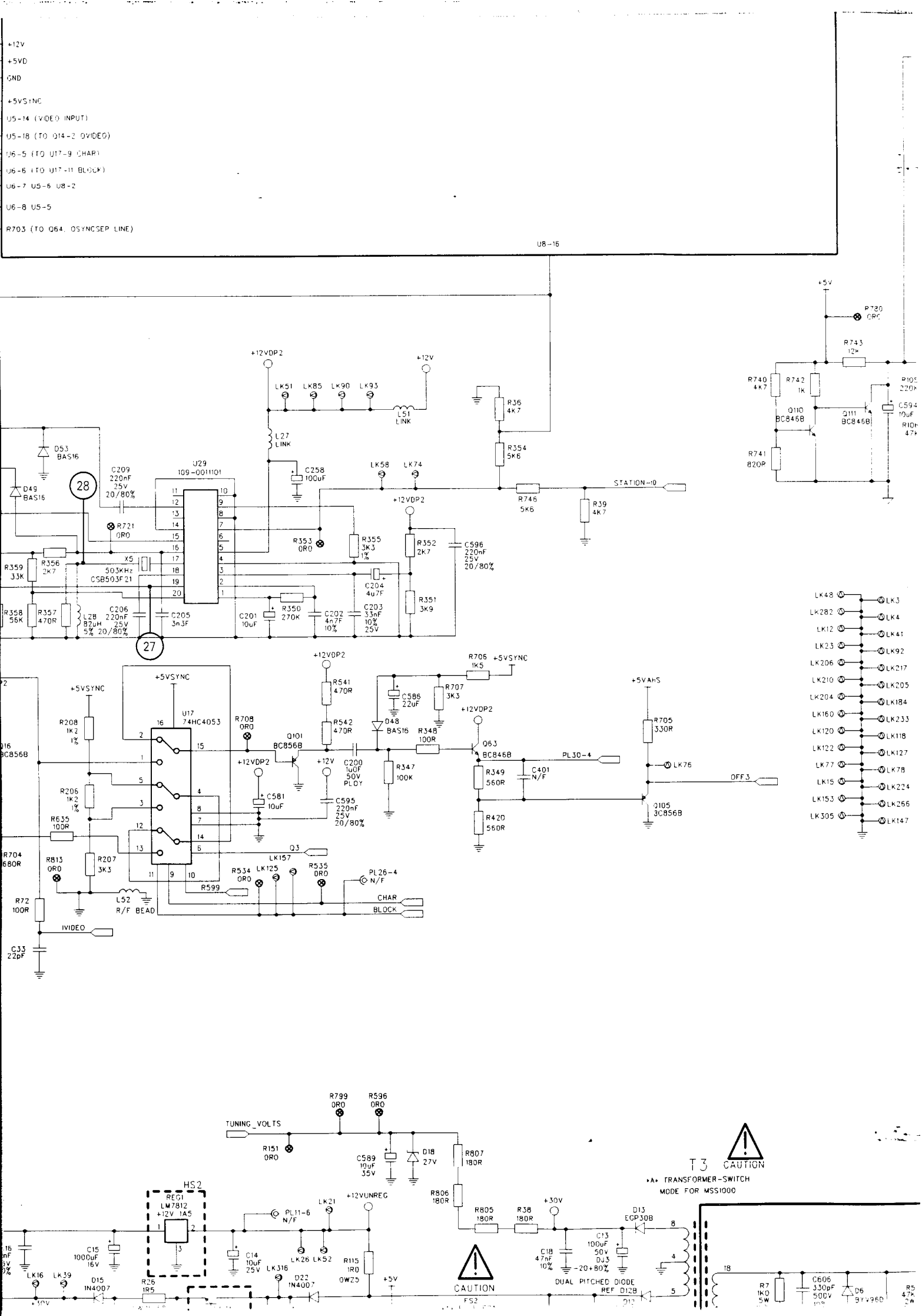
U6-6 (TO U17-11 BLOCK)

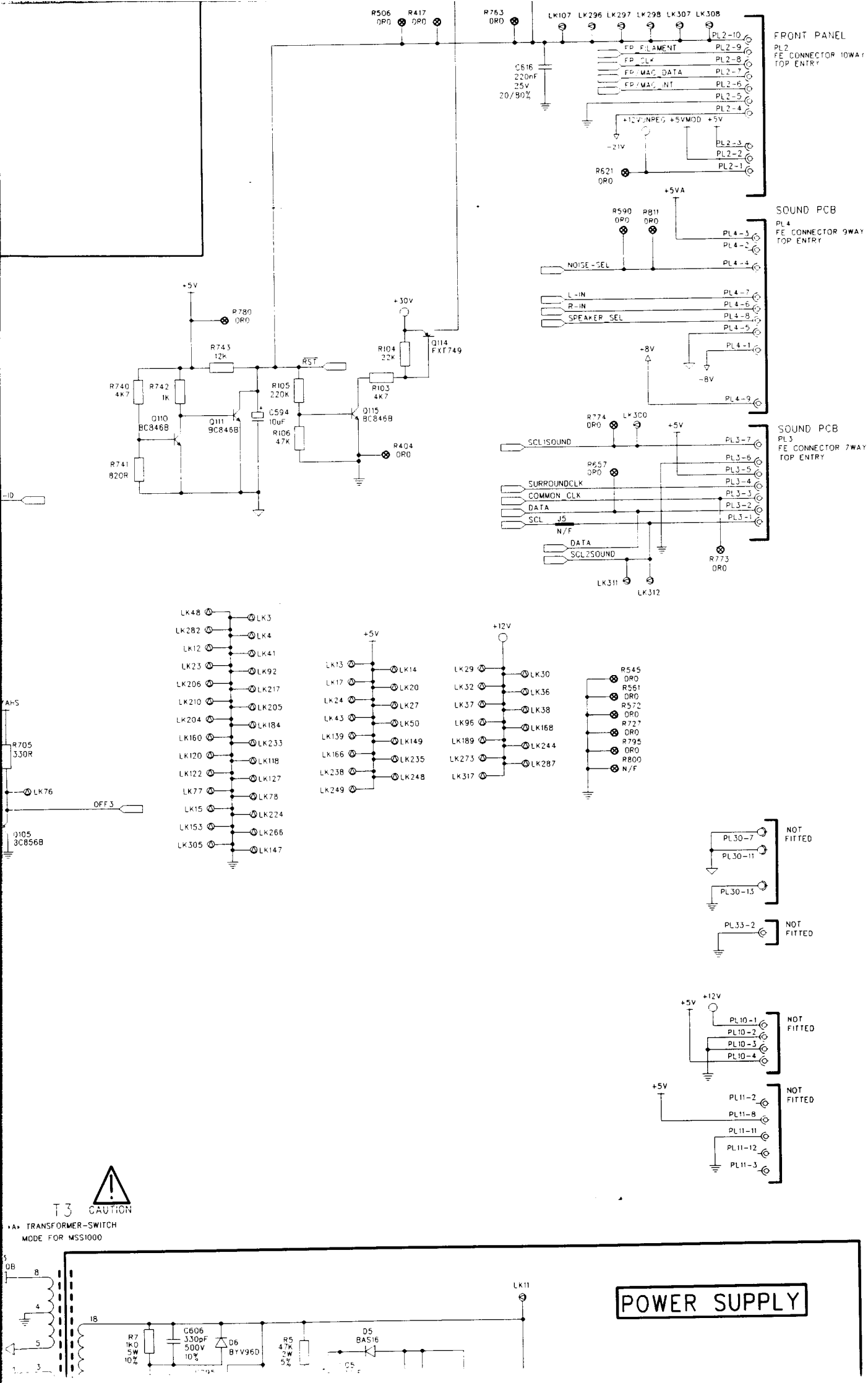
U6-7 U5-6 U8-2

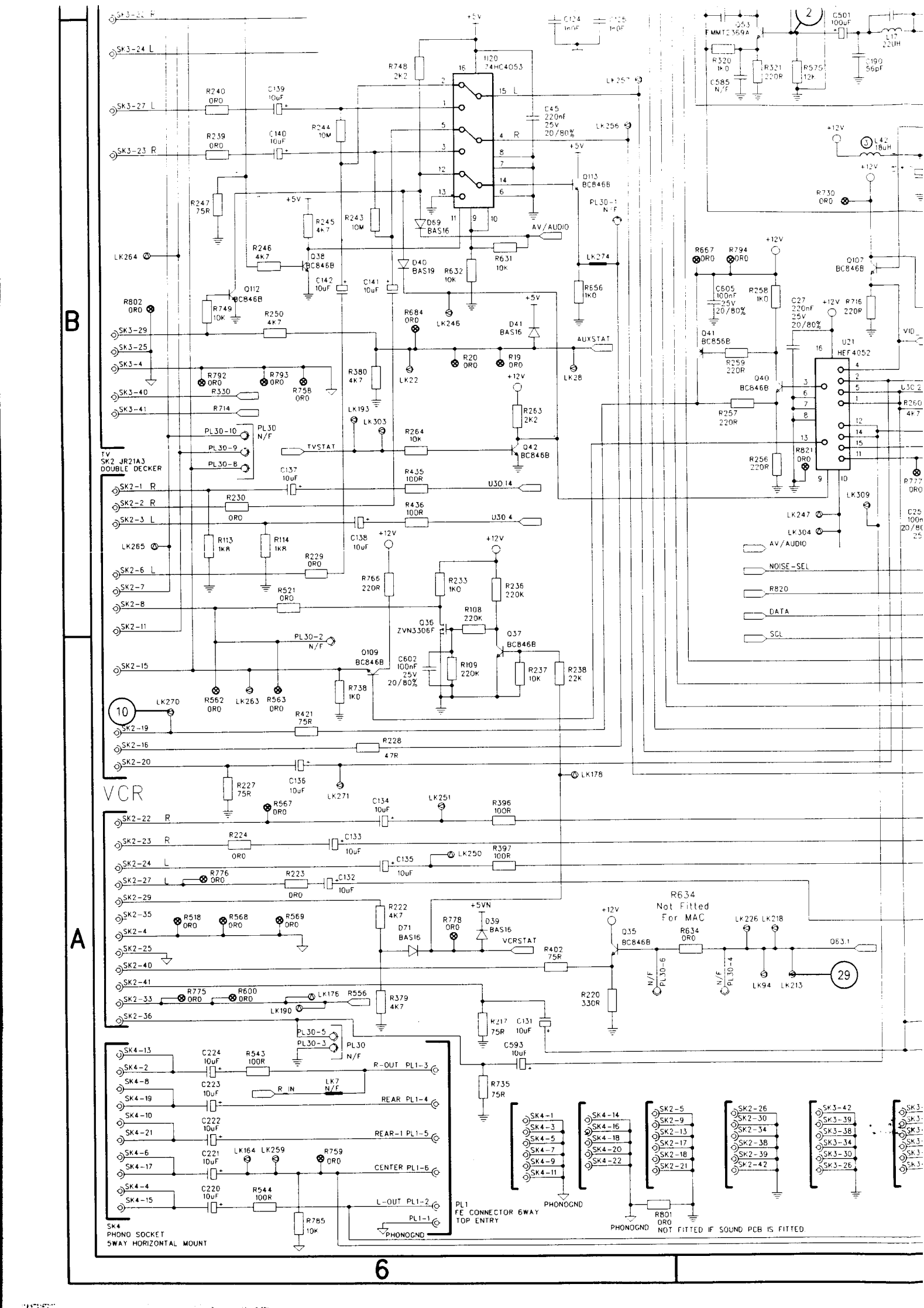
U6-8 U5-5

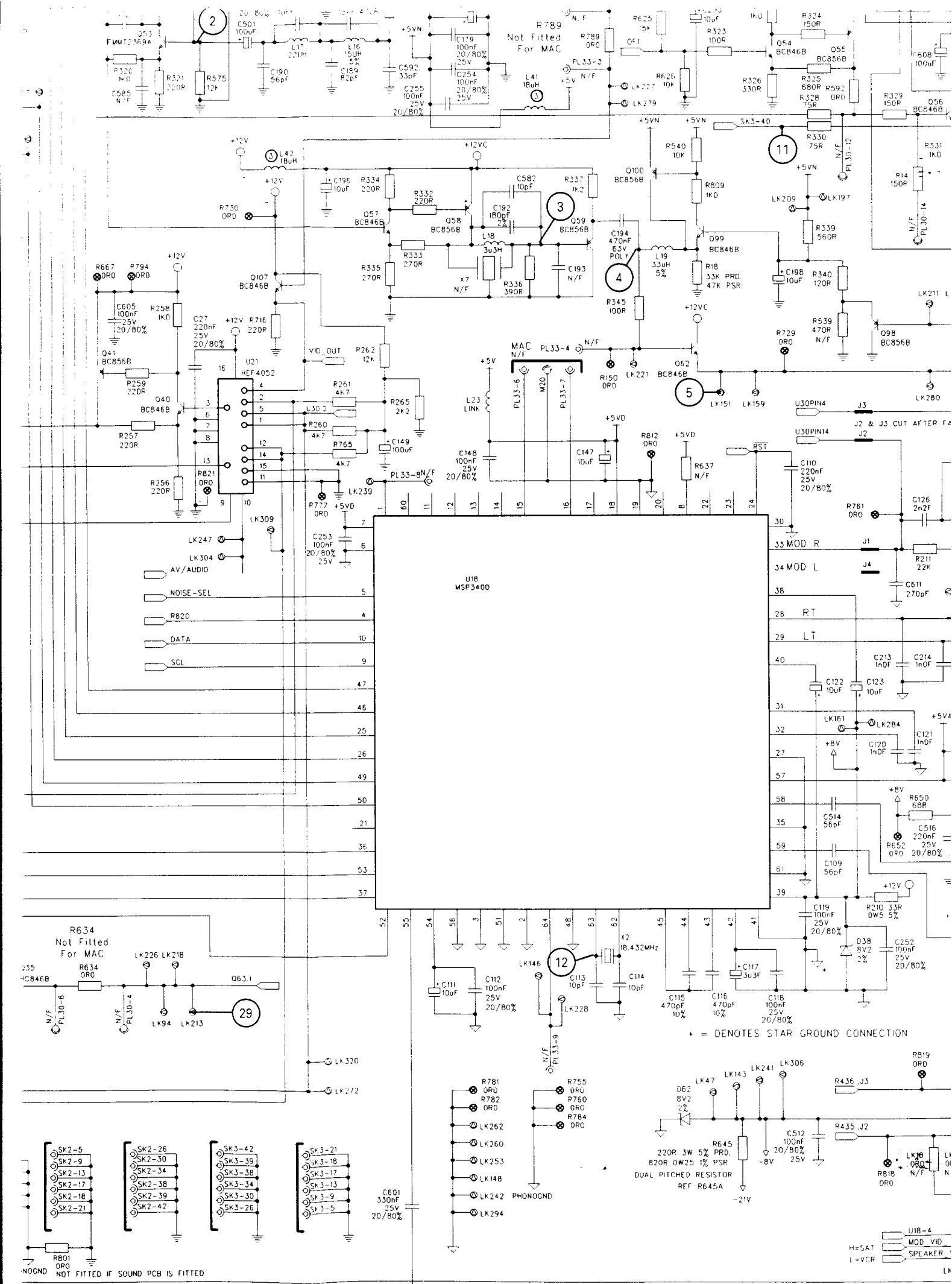
R703 (TO Q64, QSYNCSEP LINE)

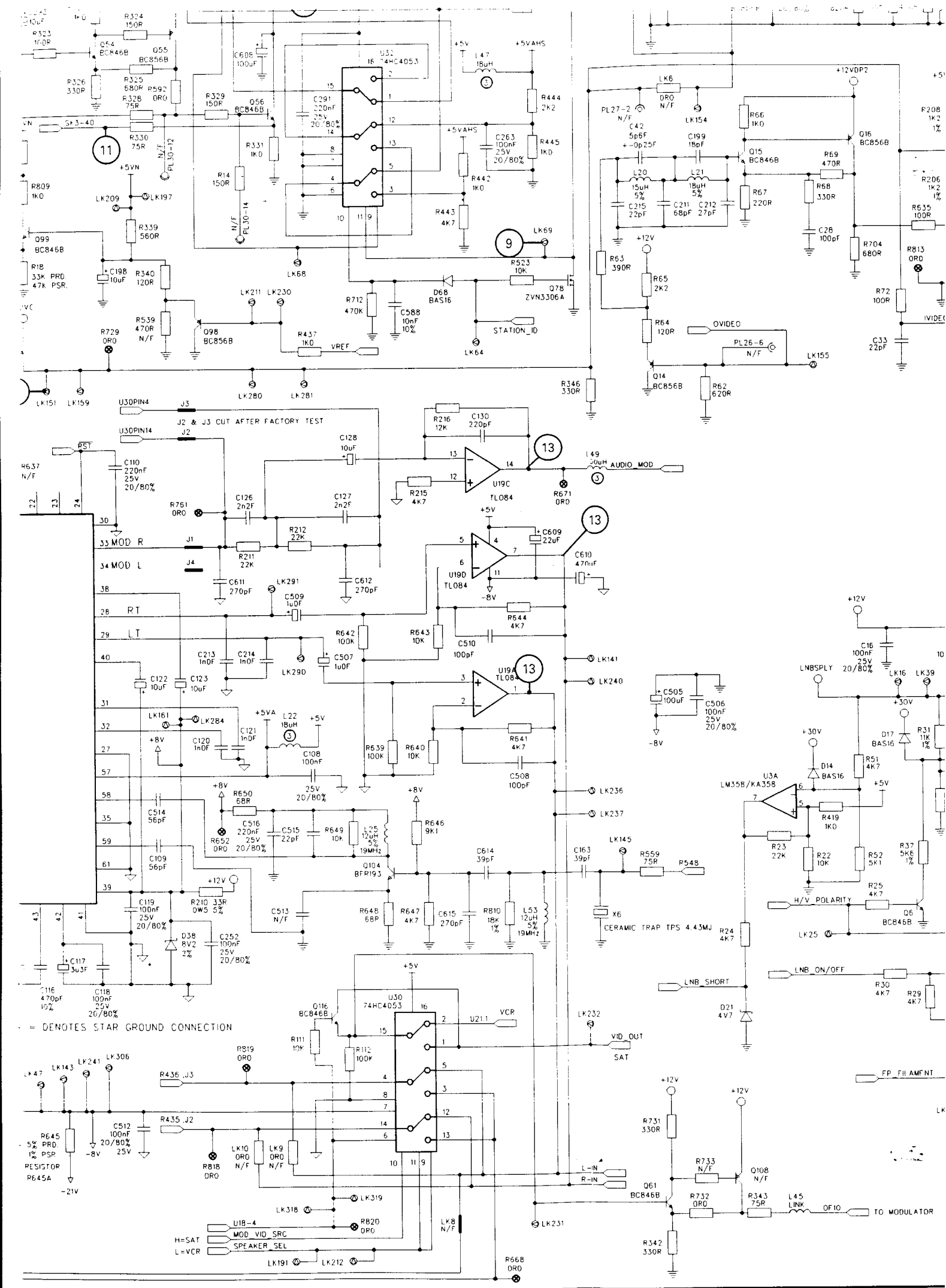
U8-16

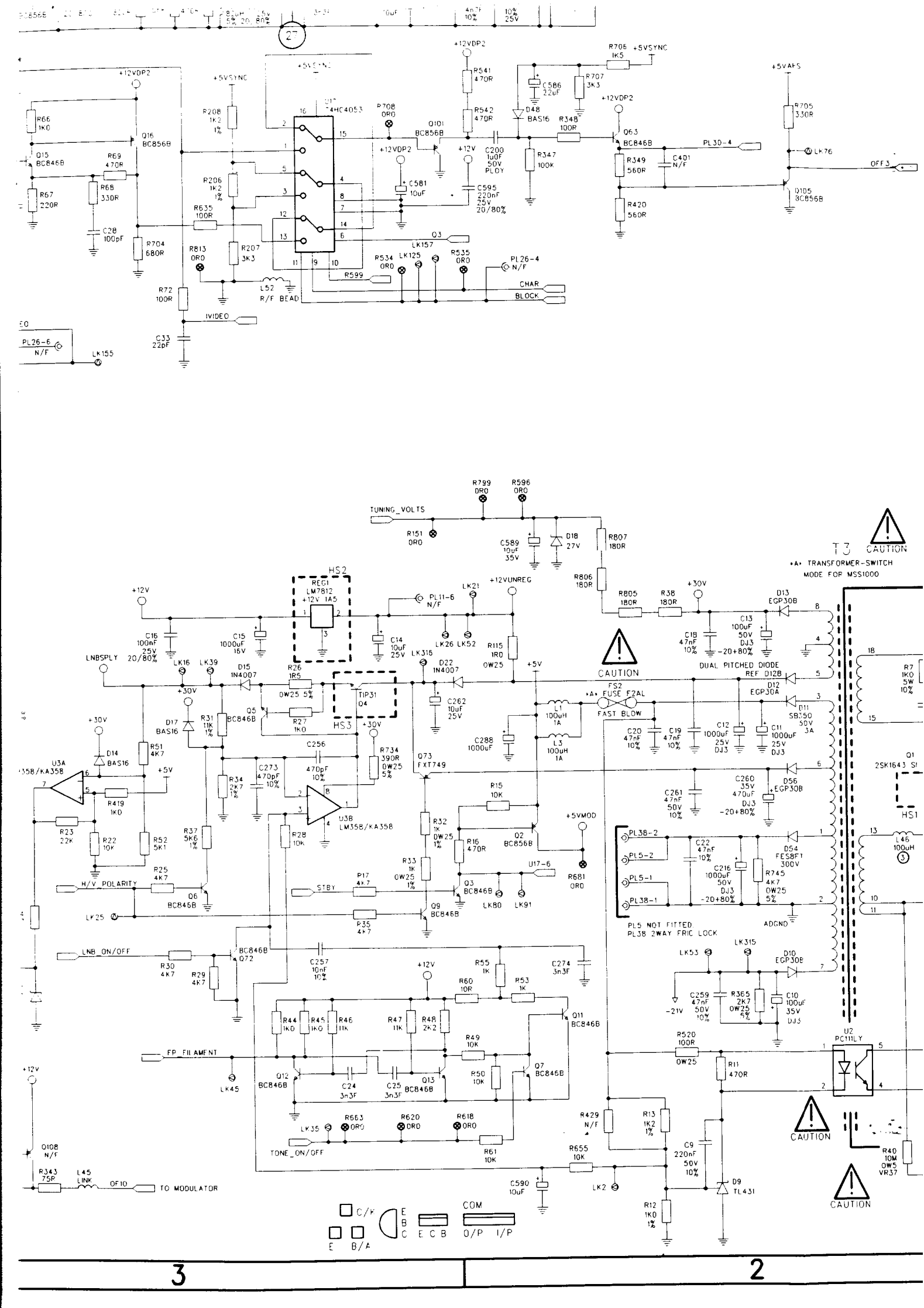


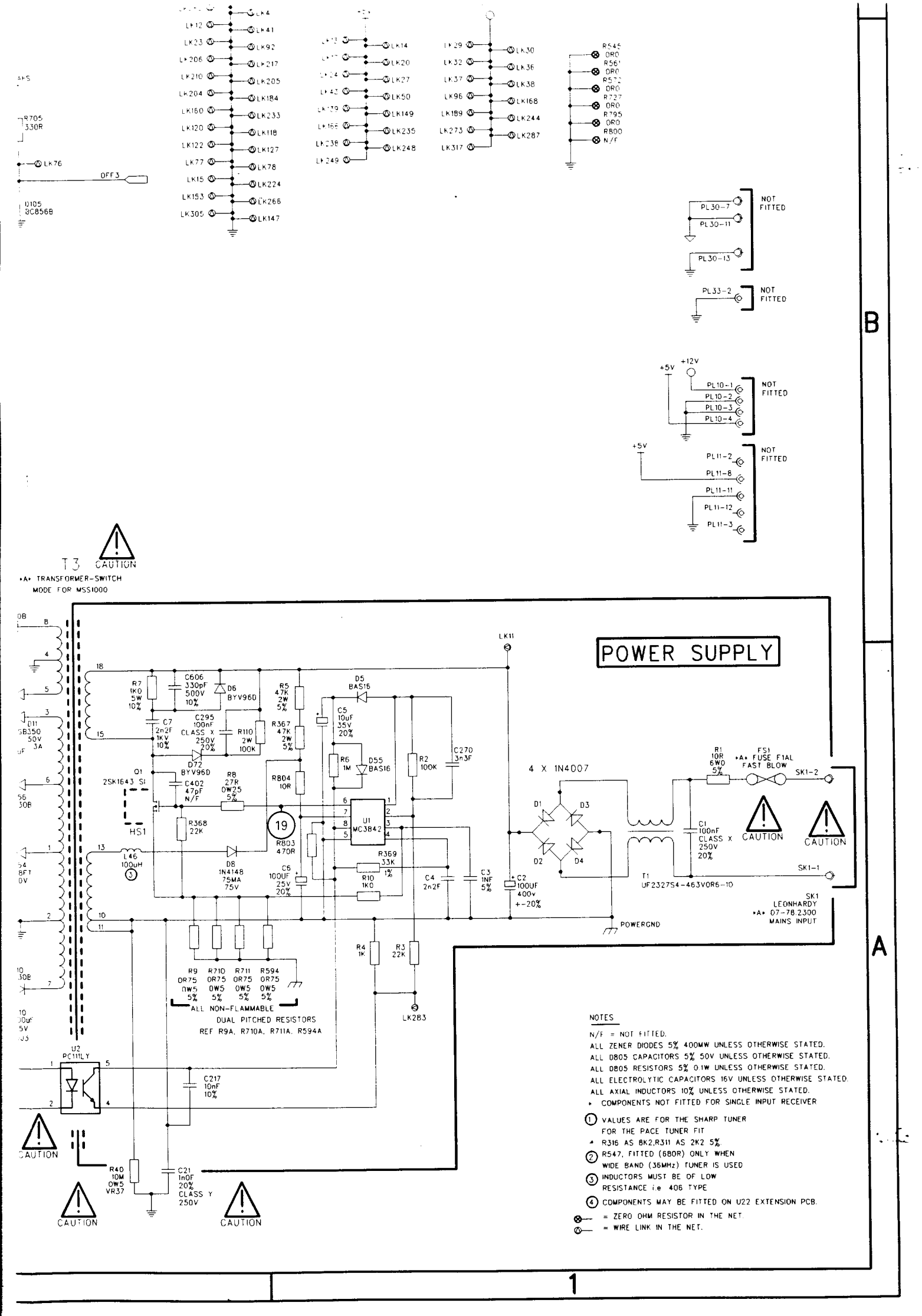

FRONT PANEL
PL2
FE CONNECTOR 10WAY
TOP ENTRY
SOUND PCB
PL4
FE CONNECTOR 9WAY
TOP ENTRY
SOUND PCB
PL3
FE CONNECTOR 7WAY
TOP ENTRY
NOT FITTED
NOT FITTED
NOT FITTED
NOT FITTED
T3
CAUTION
TRANSFORMER-SWITCH
MODE FOR MSS1000
POWER SUPPLY
C
B


B
A
6
TV
SK2 JR21A3
DOUBLE DECKER
VCR
SK4
PHONO SOCKET
5WAY HORIZONTAL MOUNT
PL1
FE CONNECTOR 6WAY
TOP ENTRY
R634
Not Fitted
For MAC
NOT FITTED IF SOUND PCB IS FITTED
U120
74HC4053
U21
HEF4052
AV/AUDIO
NOISE-SEL
R820
DATA
SCL
TVSTAT
VCRSTAT
AUXSTAT
PHONOGND

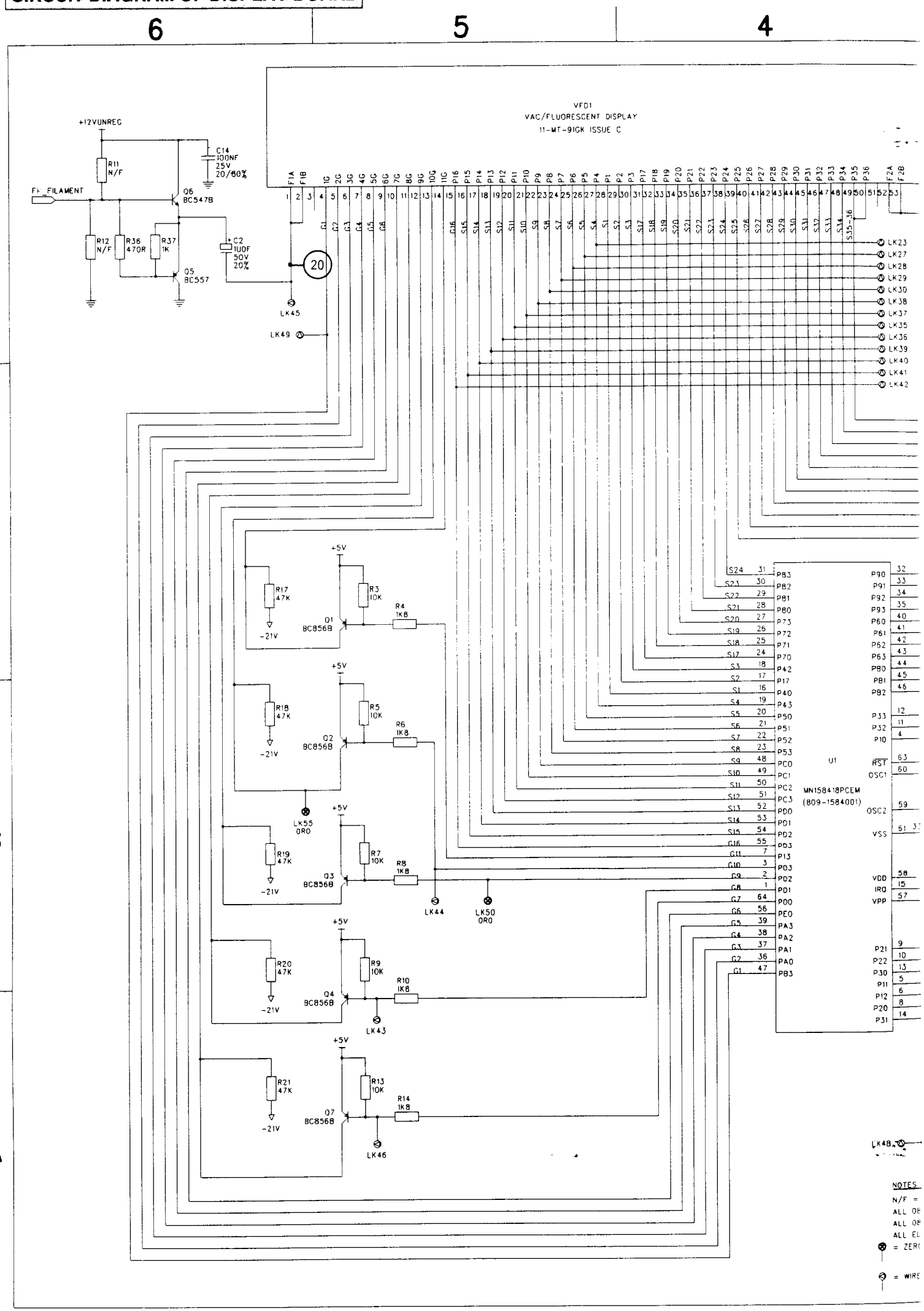

U18
MSP3400
U21
HEF4052
Q53
FMMT3906A
Q54
BC846B
Q55
BC856B
Q56
BC846B
Q57
BC846B
Q58
BC856B
Q59
BC856B
Q62
BC846B
Q63.1
Q98
BC856B
Q99
BC846B
Q100
BC856B
Q107
BC846B
Q40
BC846B
Q41
BC856B
R789
Not Fitted
For MAC
R634
Not Fitted
For MAC
MAC
N/F
AV/AUDIO
NOISE-SEL
R820
DATA
SCL
VID_OUT
PHONOGND
J2 & J3 CUT AFTER FA
MOD R
MOD L
RT
LT
RST
X2
18.432MHz
+5VN
+12V
+12VC
+5V
+5VD
+8V
-8V
-21V
* = DENOTES STAR GROUND CONNECTION
R801
0R0
NOT FITTED IF SOUND PCB IS FITTED
H=SAT
L=VCR
MOD_VID
SPEAKER

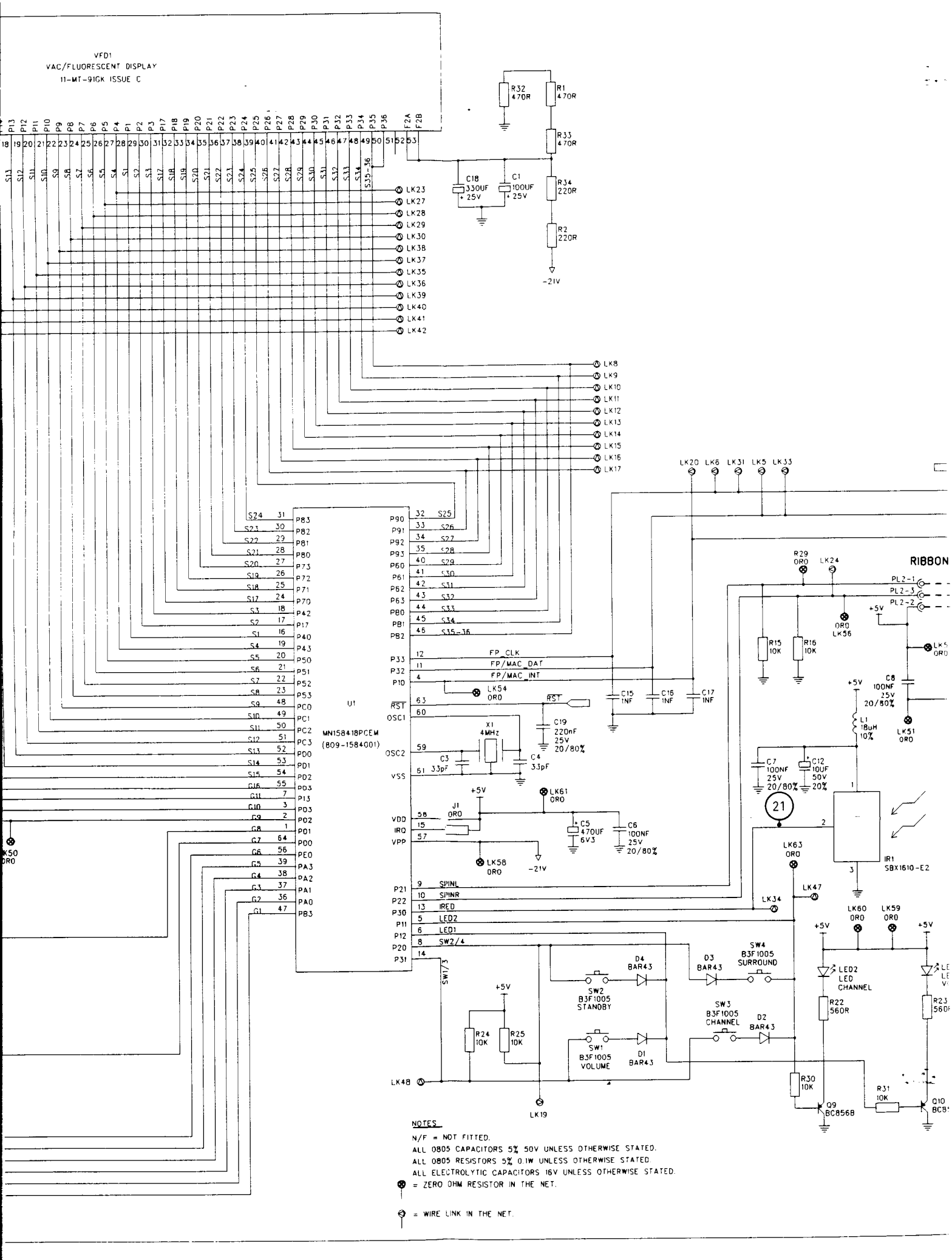

J2 & J3 CUT AFTER FACTORY TEST
= DENOTES STAR GROUND CONNECTION
U30PIN4
U30PIN14
MOD R
MOD L
RT
LT
AUDIO_MOD
STATION_ID
VREF
OVIDEO
LNBSPLY
LNB_SHORT
LNB_ON/OFF
H/V_POLARITY
FP_FILAMENT
VID_OUT
SAT
VCR
TO MODULATOR
CERAMIC TRAP TPS 4.43MJ
MOD_VID_SRC
SPEAKER_SEL
H=SAT
L=VCR
L-IN
R-IN
+5V
+5VAHS
+12V
+12VDP2
+30V
+8V
-8V
-21V
+5VA
+5VN
TL084
74HC4053
BC846B
BC856B
ZVN3306A
BAS16
BFR93
LM358/KA358


+12VDP2
+5VSYNC
R66 1K0
Q16 BC856B
Q15 BC846B
R69 470R
R68 330R
R67 220R
C28 100pF
R704 680R
R208 1K2 1%
R206 1K2 1%
R635 100R
R207 3K3
R813 0R0
L52 R/F BEAD
R72 100R
IVIDEO
C33 22pF
PL26-6 N/F
LK155
U17 74HC4053
R708 0R0
Q101 BC856B
+12V
C200 1uF 50V PLOY
C581 10uF
C595 220nF 25V 20/80%
R541 470R
R542 470R
C586 22uF
R707 3K3
R705 1K5
D48 BAS16
R348 100R
R347 100K
Q63 BC846B
R349 560R
R420 560R
C401 N/F
PL30-4
+5VAFS
R705 330R
LK76
OFF3
Q105 BC856B
Q3
LK157
R534 0R0
LK125
R535 0R0
PL26-4 N/F
R599
CHAR
BLOCK
TUNING_VOLTS
R151 0R0
R799 0R0
R596 0R0
C589 10uF 35V
D18 27V
R807 180R
R806 180R
R805 180R
R38 180R
+30V
D13 EGP30B
C13 100uF 50V DJ3
C18 47nF 10%
-20+80%
DUAL PITCHED DIODE
REF D12B
D12 EGP30A
D11 SB350 50V 3A
T3
CAUTION
A TRANSFORMER-SWITCH
MODE FOR MSS1000
HS2
REG1 LM7812 +12V 1A5
PL11-6 N/F
LK21
+12VUNREG
C16 100nF 25V 20/80%
C15 1000uF 16V
C14 10uF 25V
LK26 LK52
R115 1R0 0W25
LK315
LNBSPLY
LK16 LK39
D15 1N4007
R26 1R5 0W25 5%
TIP31 Q4
D22 1N4007
C262 10uF 25V
+5V
FS2 *A* FUSE F2AL FAST BLOW
L1 100uH 1A
L3 100uH 1A
C288 1000uF
C20 47nF 10%
C19 47nF 10%
C12 1000uF 25V DJ3
C11 1000uF 25V DJ3
HS3
Q5 BC846B
R27 1K0
D17 BAS16
R31 11K 1%
D14 BAS16
R51 4K7
U3A LM358/KA358
R419 1K0
R23 22K
R22 10K
R52 5K1
R37 5K6 1%
R34 2K7 1%
C273 470pF 10%
C256 470pF 10%
R734 390R 0W25 5%
Q73 FXT749
U3B LM358/KA358
R28 10K
R15 10K
R32 1K 0W25 1%
R16 470R
Q2 BC856B
+5VMOD
R33 1K 0W25 1%
U17-6
R681 0R0
H/V_POLARITY
R25 4K7
Q6 BC846B
P17 4K7
STBY
Q3 BC846B
LK80
LK91
Q9 BC846B
R35 4K7
LK25
LNB_ON/OFF
R30 4K7
R29 4K7
Q72 BC846B
C257 10nF 10%
C274 3n3F
R55 1K
R53 1K
R60 10R
+12V
R44 1K0
R45 1K0
R46 1K
R47 1K
R48 2K2
Q11 BC846B
R49 10K
FP_FILAMENT
LK45
Q12 BC846B
C24 3n3F
C25 3n3F
Q13 BC846B
R50 10K
Q7 BC846B
R663 0R0
R620 0R0
R618 0R0
LK35
TONE_ON/OFF
R61 10K
Q108 N/F
R343 75R
L45 LINK
OF10
TO MODULATOR
PL38-2
PL5-2
PL5-1
PL38-1
C22 47nF 10%
C216 1000uF 50V DJ3 -20+80%
D54 FES8FT 300V
R745 4K7 0W25 5%
ADGND
PL5 NOT FITTED
PL38 2WAY FRIC LOCK
C261 47nF 50V 10%
C260 35V 470uF DJ3 -20+80%
D56 EGP30B
LK53
LK315
D10 EGP30B
C259 47nF 50V 10%
R365 2K7 0W25 5%
C10 100uF 35V DJ3
-21V
R520 100R 0W25
U2 PC111LY
R11 470R
R429 N/F
R13 1K2 1%
C9 220nF 50V 10%
D9 TL431
R655 10K
LK2
C590 10uF
R12 1K0 1%
R40 10M 0W5 VR37
Q1 2SK1643 S1
HS1
L46 100uH
C/P
E B C
E C B
COM
O/P I/P
E B/A


POWER SUPPLY
T3
CAUTION
A TRANSFORMER-SWITCH MODE FOR MSS1000
4 X 1N4007
U1 MC3842
U2 PC111LY
T1 UF2327S4-463V0R6-10
SK1 LEONHARDY *A* 07-78.2300 MAINS INPUT
FS1 *A* FUSE F1AL FAST BLOW
HS1
2SK1643 SI
BYV96D
BAS16
BAS16
1N4148 75MA 75V
POWERGND
LK11
LK283
ALL NON-FLAMMABLE
DUAL PITCHED RESISTORS
REF R9A, R710A, R711A, R594A
NOT FITTED
PL30-7
PL30-11
PL30-13
PL33-2
PL10-1
PL10-2
PL10-3
PL10-4
PL11-2
PL11-8
PL11-11
PL11-12
PL11-3
+5V
+12V
NOTES
N/F = NOT FITTED.
ALL ZENER DIODES 5% 400MW UNLESS OTHERWISE STATED.
ALL 0805 CAPACITORS 5% 50V UNLESS OTHERWISE STATED.
ALL 0805 RESISTORS 5% 0.1W UNLESS OTHERWISE STATED.
ALL ELECTROLYTIC CAPACITORS 16V UNLESS OTHERWISE STATED.
ALL AXIAL INDUCTORS 10% UNLESS OTHERWISE STATED.
* COMPONENTS NOT FITTED FOR SINGLE INPUT RECEIVER
(1) VALUES ARE FOR THE SHARP TUNER
FOR THE PACE TUNER FIT
* R316 AS 8K2,R311 AS 2K2 5%
(2) R547, FITTED (680R) ONLY WHEN WIDE BAND (36MHz) TUNER IS USED
(3) INDUCTORS MUST BE OF LOW RESISTANCE i.e 406 TYPE
(4) COMPONENTS MAY BE FITTED ON U22 EXTENSION PCB.
= ZERO OHM RESISTOR IN THE NET.
= WIRE LINK IN THE NET.
B
A
1

CIRCUIT DIAGRAM OF DISPLAY BOARD





NOTES

N/F = NOT FITTED.

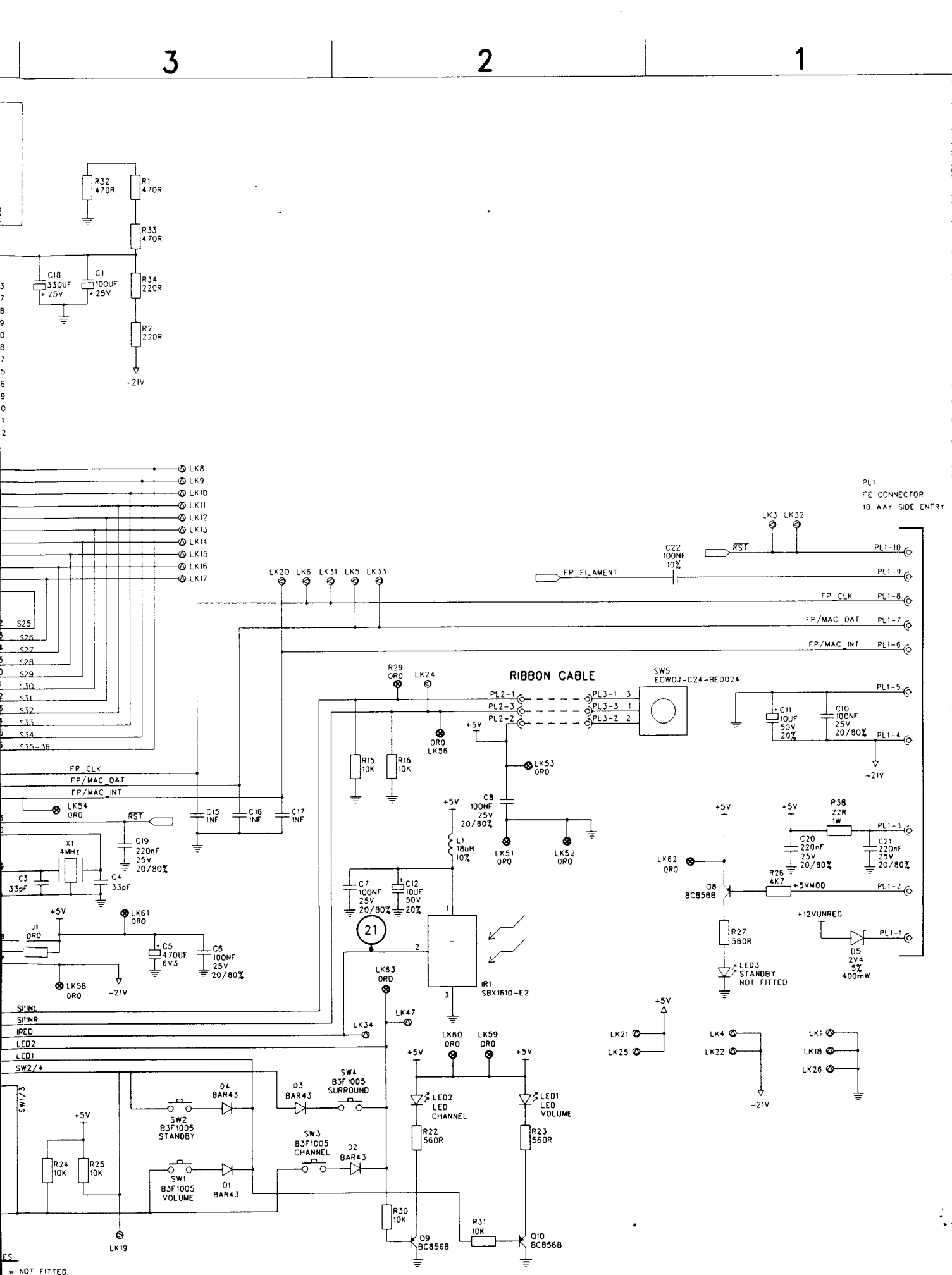
ALL 0805 CAPACITORS 5% 50V UNLESS OTHERWISE STATED.

ALL 0805 RESISTORS 5% 0.1W UNLESS OTHERWISE STATED.

ALL ELECTROLYTIC CAPACITORS 16V UNLESS OTHERWISE STATED.

⊗ = ZERO OHM RESISTOR IN THE NET.

⊗ = WIRE LINK IN THE NET.



ES

= NOT FITTED.

0805 CAPACITORS 5% 50V UNLESS OTHERWISE STATED.

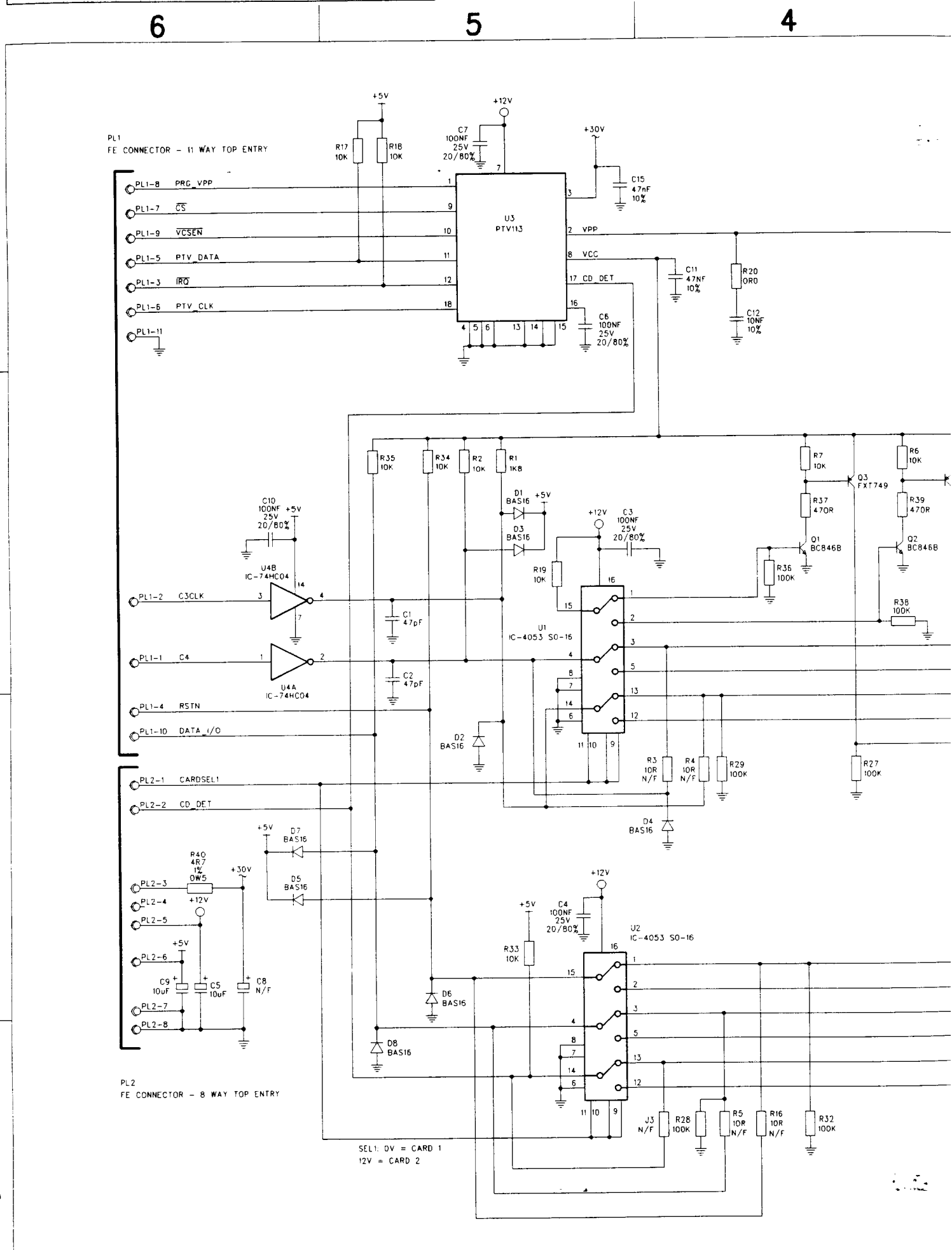
0805 RESISTORS 5% 0.1W UNLESS OTHERWISE STATED.

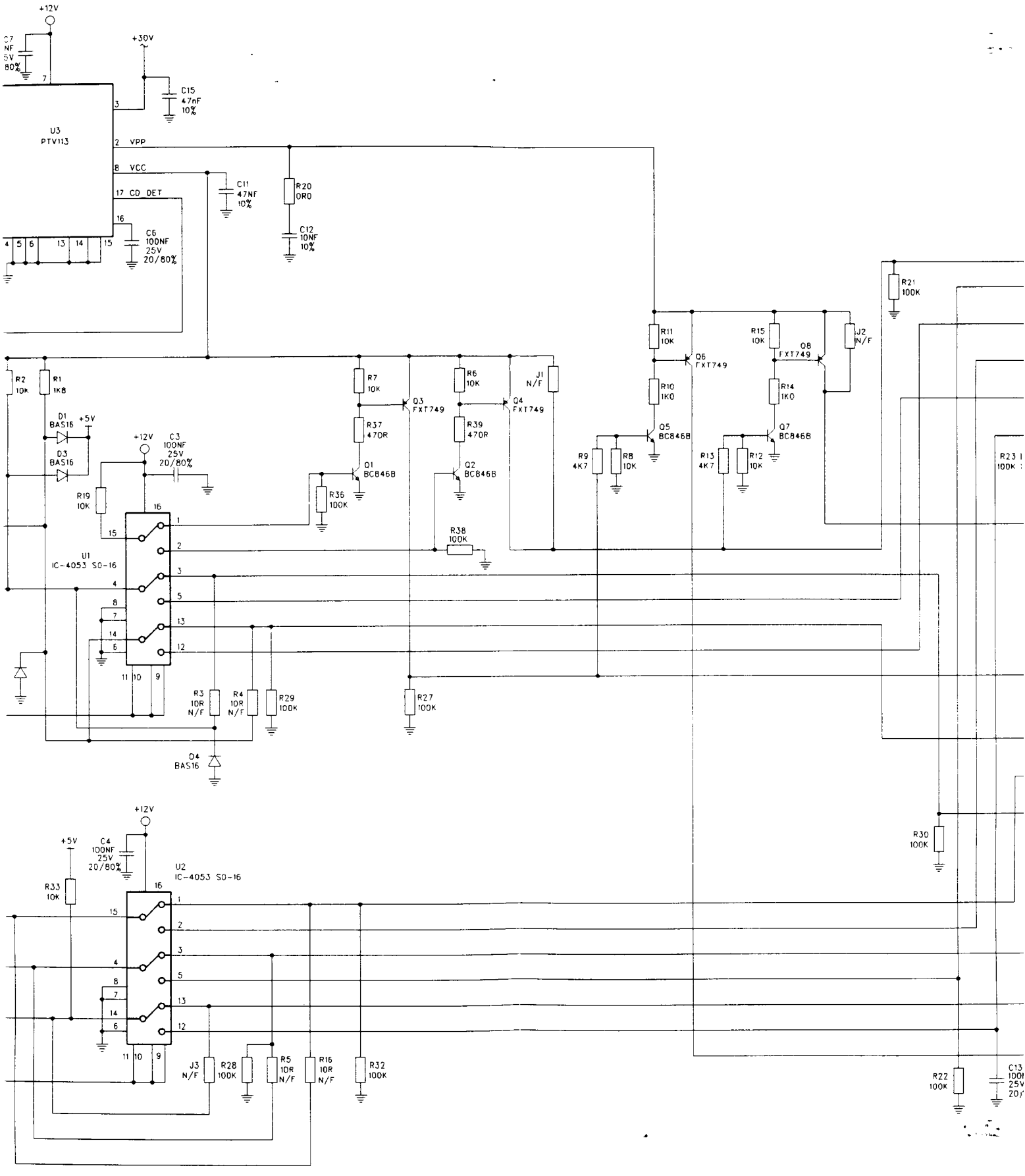
ELECTROLYTIC CAPACITORS 16V UNLESS OTHERWISE STATED.

ERO OHM RESISTOR IN THE NET.

VIRE LINK IN THE NET.

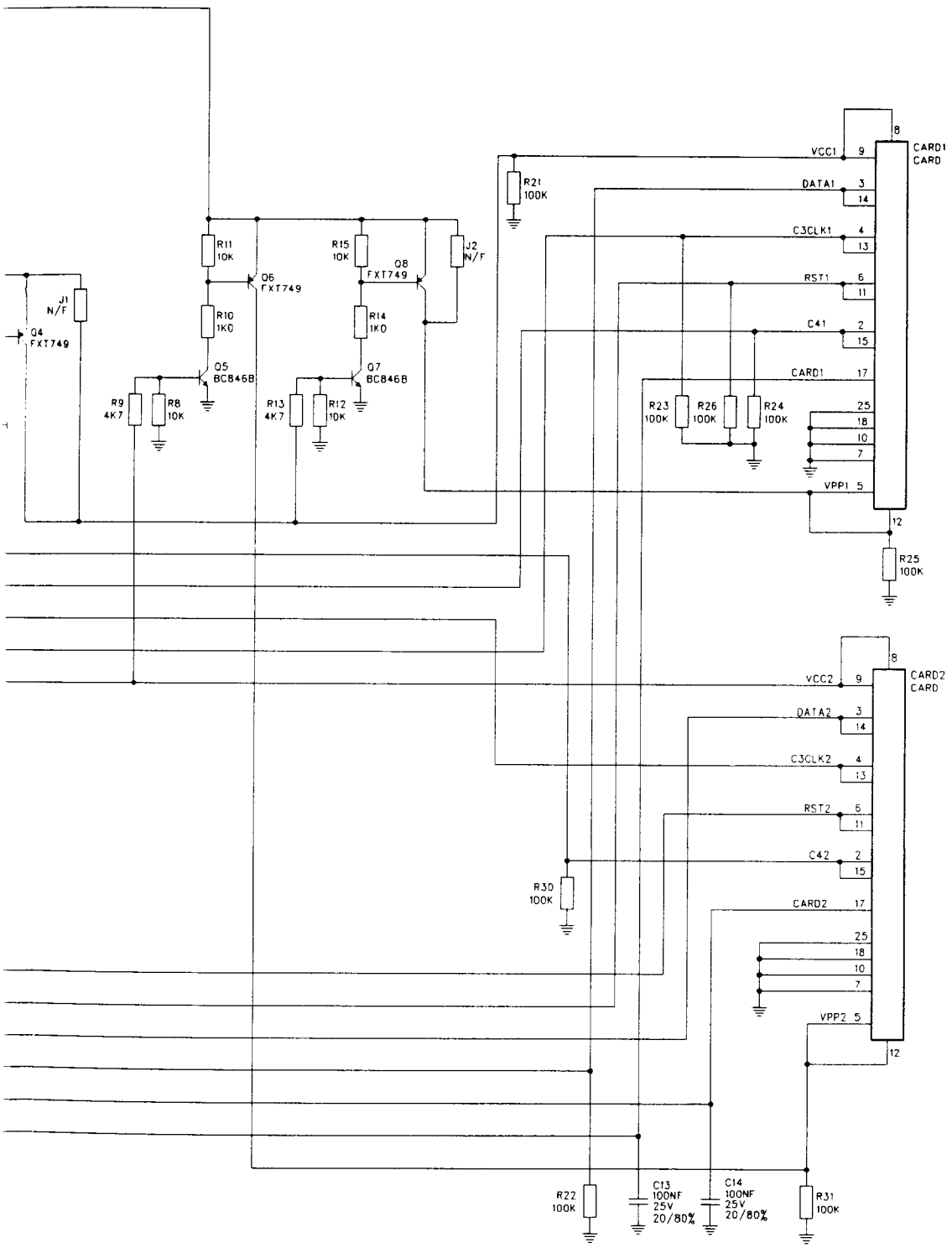
CIRCUIT DIAGRAM OF CARD READER BOARD





NOTE :-

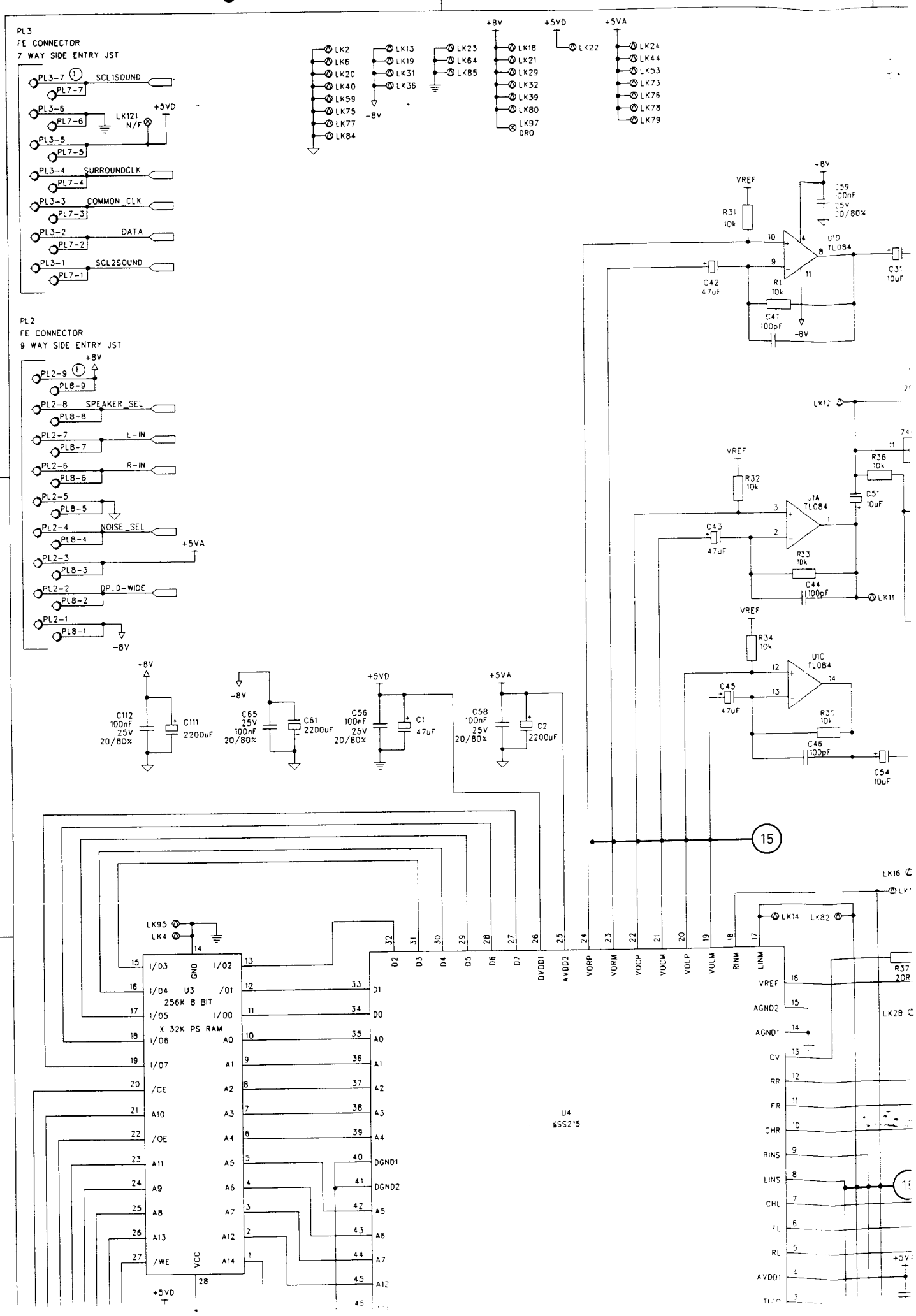
N/F = NOT FITTED.
ALL 0805 CAPACITORS ARE 50V 5% UNLESS OTHERWISE STA
ALL ELECTROLYTIC CAPACITORS ARE 16V 5MM RADIAL UNLESS
ALL 0805 RESISTORS ARE 0.1W 5% UNLESS OTHERWISE STATE
TP = TEST PAD
CARD = SMART CARD READER-ALCATEL 7001LM0416T2F08

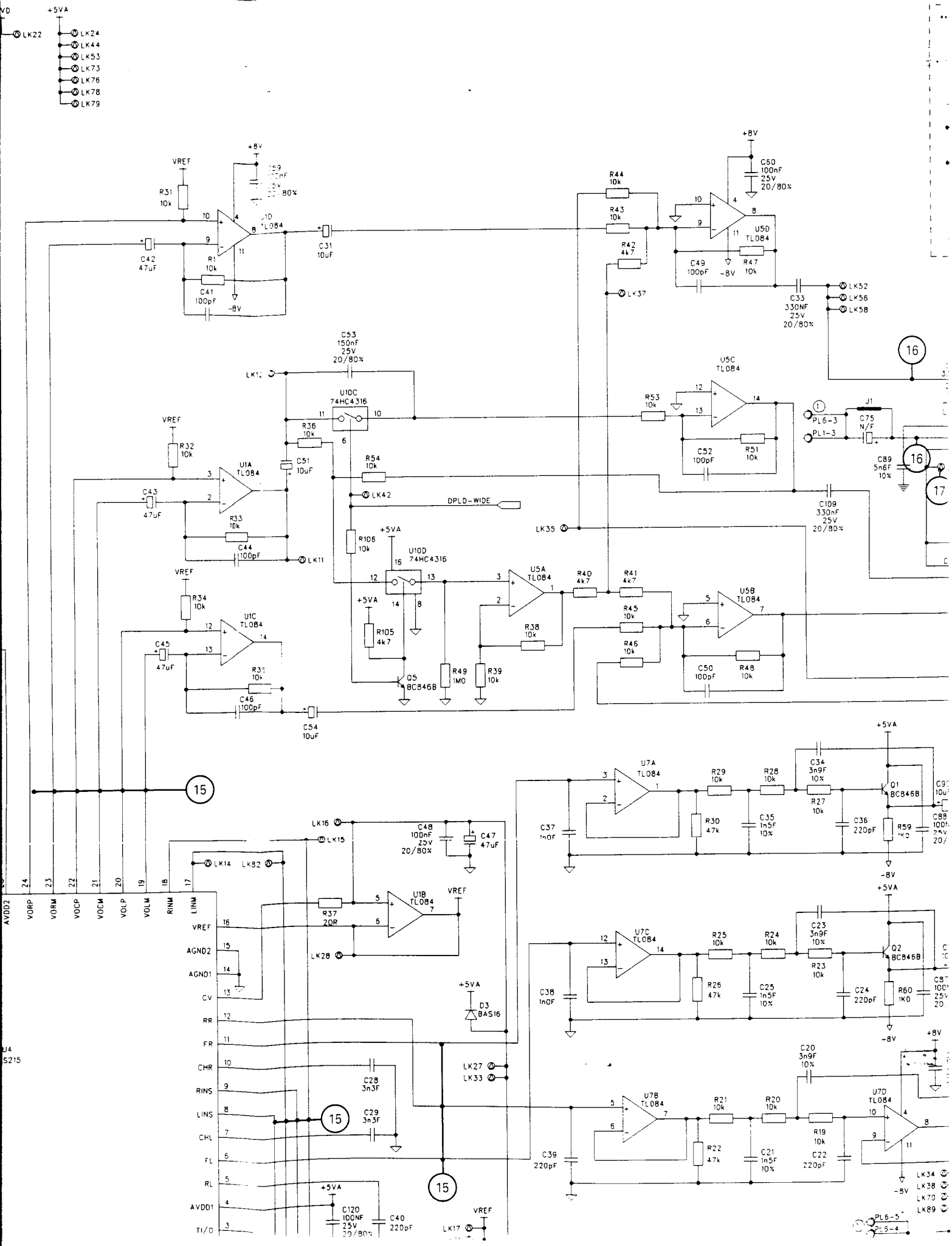


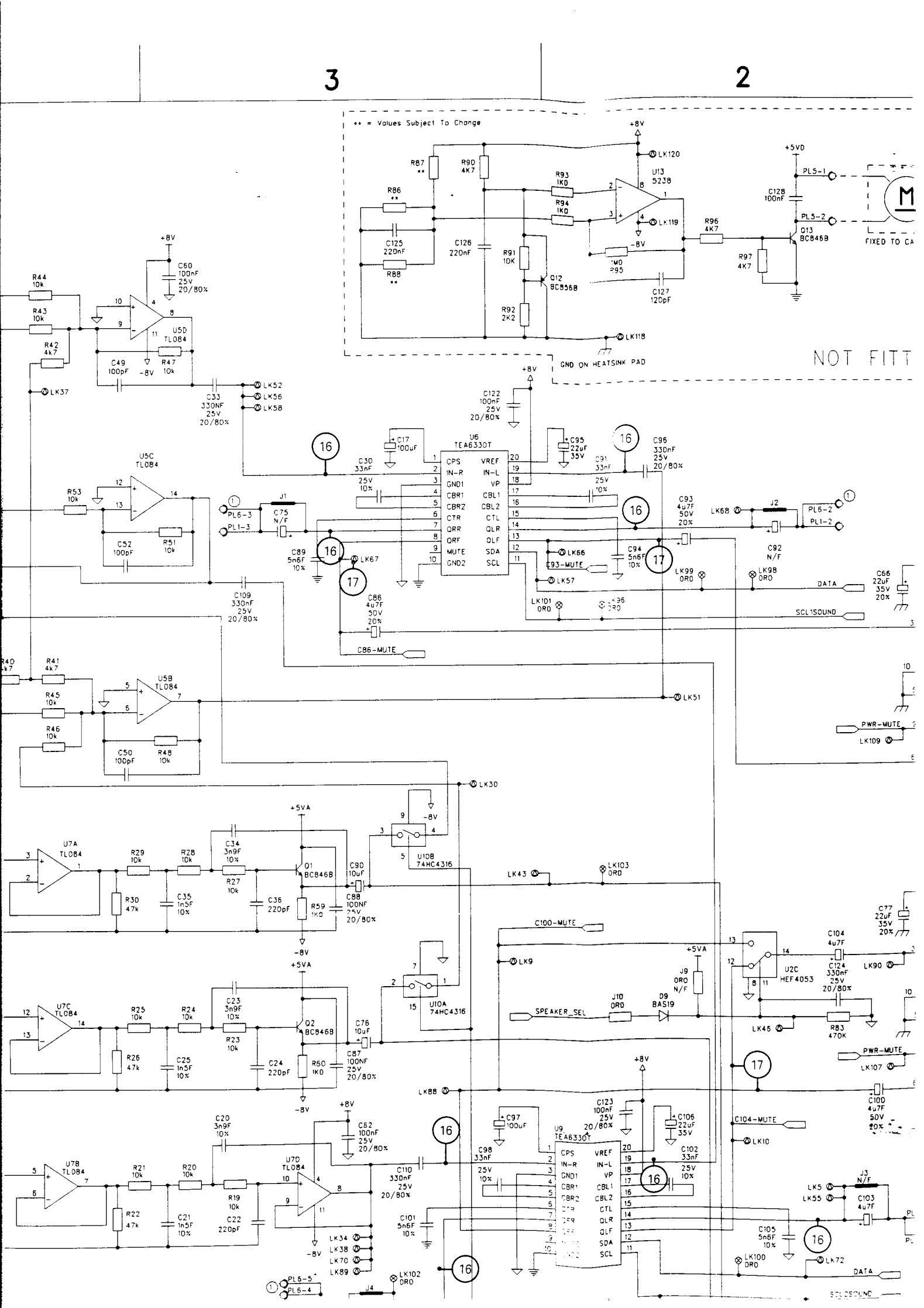
NOTE :-

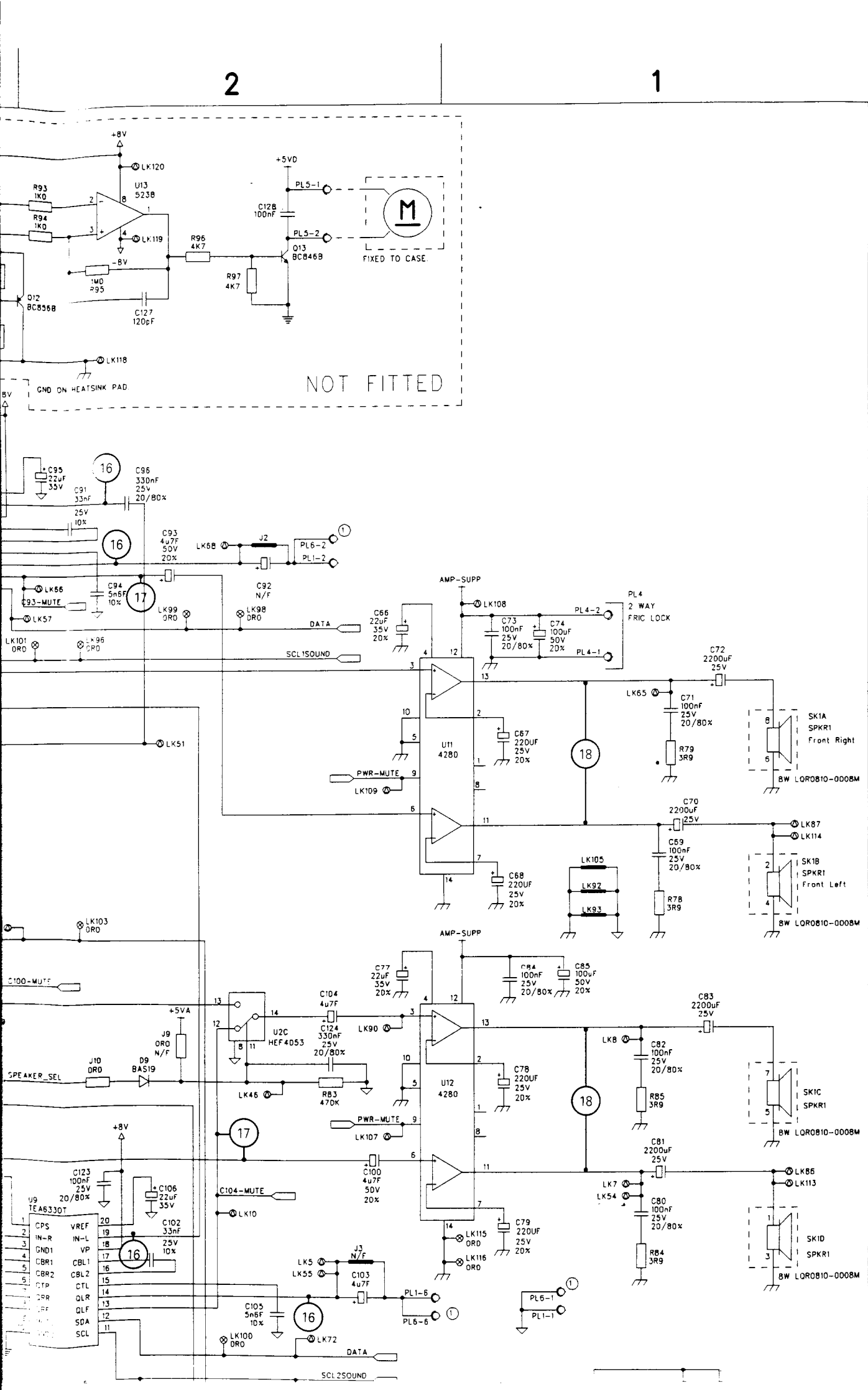
N/F = NOT FITTED.
ALL 0805 CAPACITORS ARE 50V 5% UNLESS OTHERWISE STATED.
ALL ELECTROLYTIC CAPACITORS ARE 16V 5MM RADIAL UNLESS OTHERWISE STATED.
ALL 0805 RESISTORS ARE 0.1W 5% UNLESS OTHERWISE STATED.
TP = TEST PAD
CARD = SMART CARD READER-ALCATEL 7001LM0416T2F08

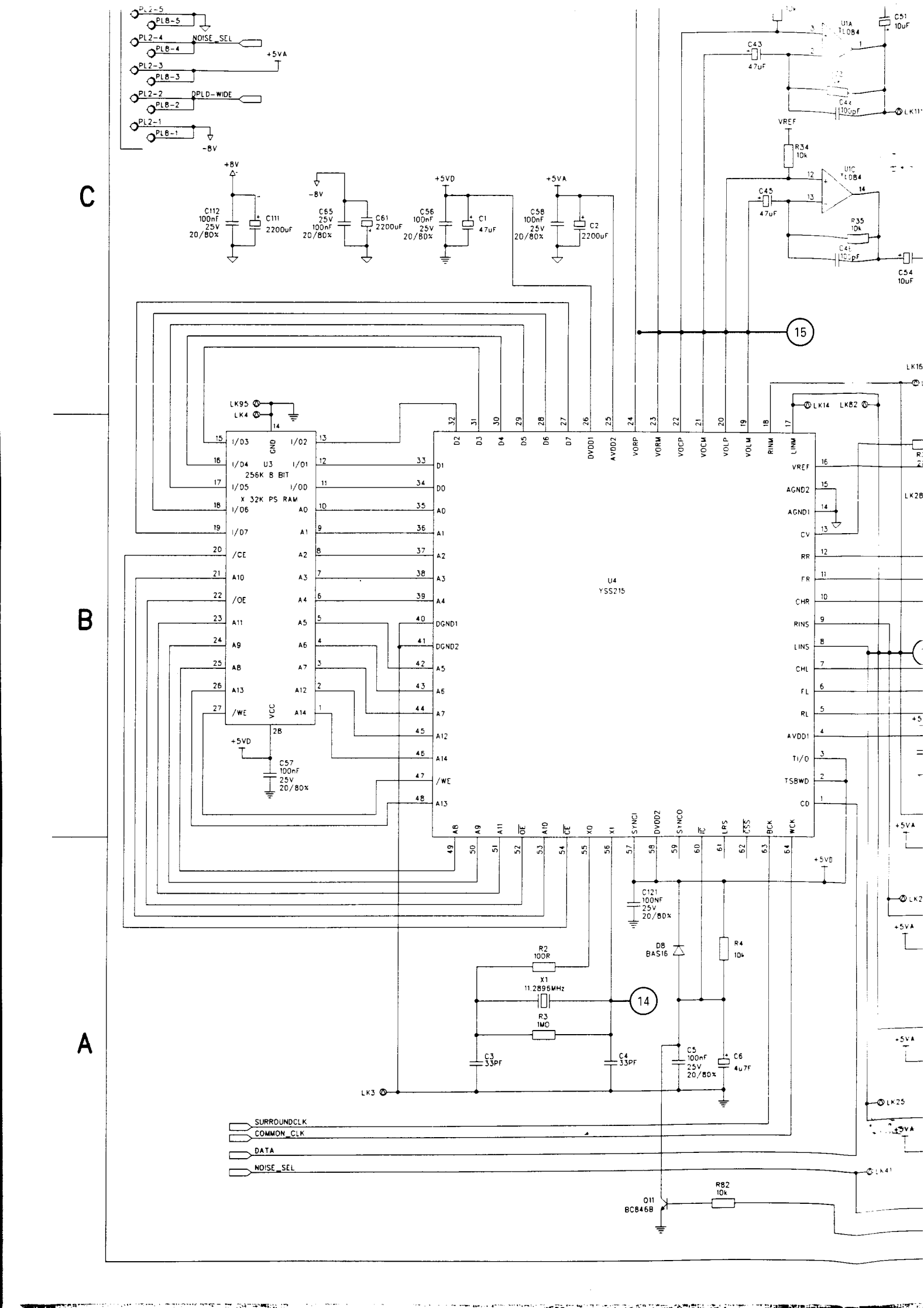
CIRCUIT DIAGRAM OF SOUND BOARD

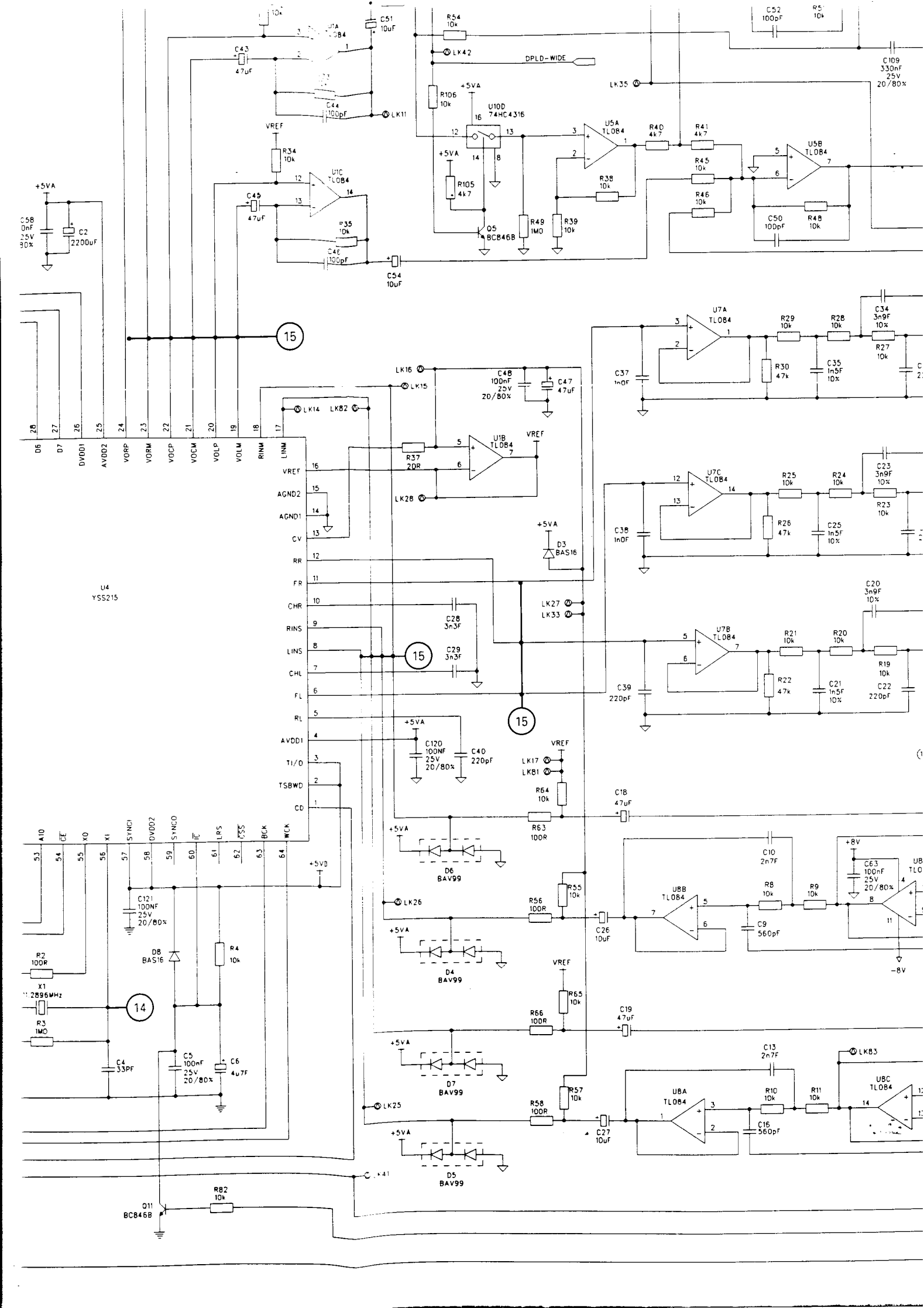


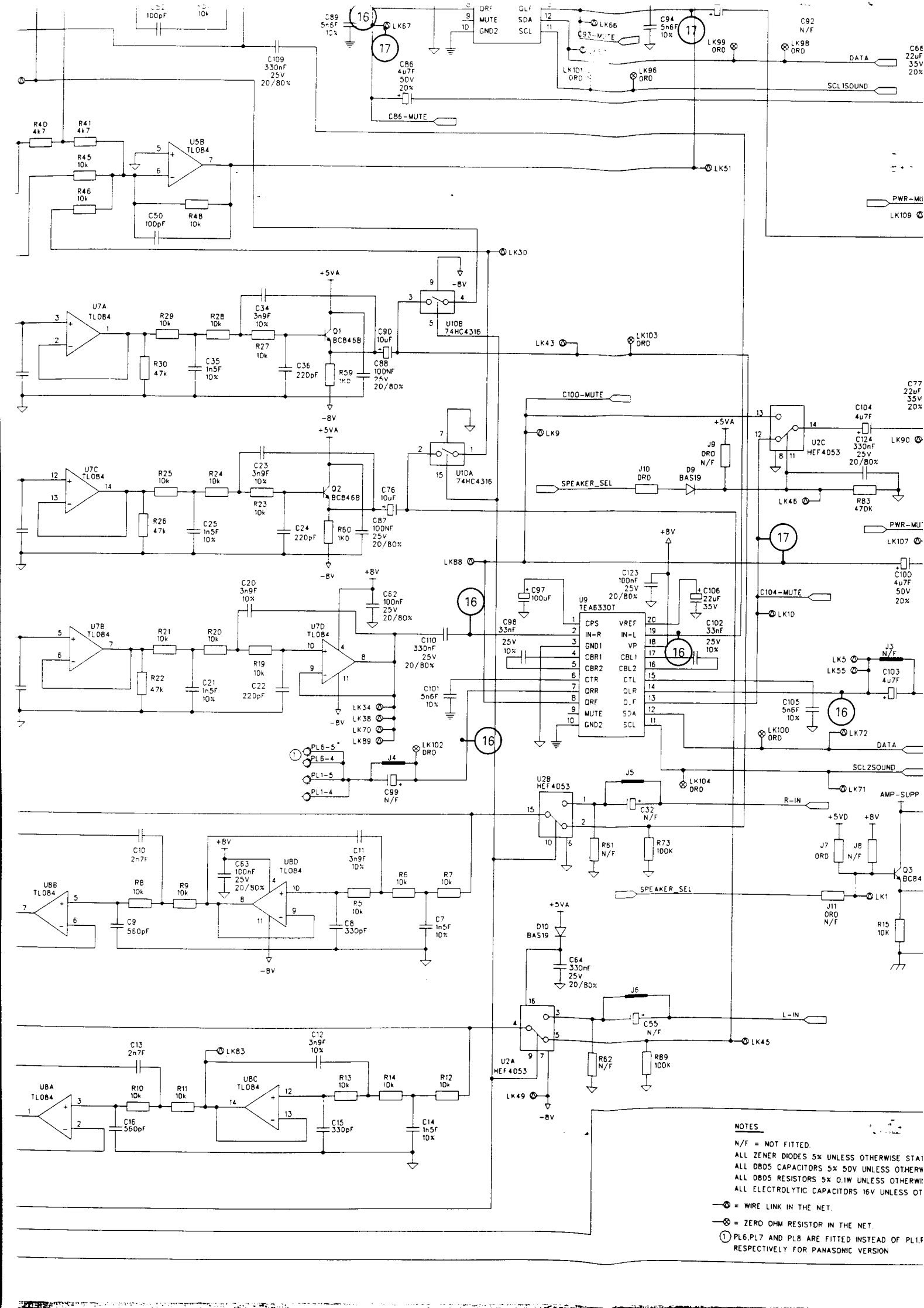

VD
+5VA
LK22
LK24
LK44
LK53
LK73
LK76
LK78
LK79
VREF
+8V
R31 10k
U1D TL084
C42 47uF
R1 10k
C41 100pF
-8V
C31 10uF
R44 10k
R43 10k
R42 4k7
LK37
U5D TL084
C60 100nF 25V 20/80%
C49 100pF
R47 10k
C33 330NF 25V 20/80%
LK52
LK56
LK58
16
C53 150nF 25V 20/80%
LK12
U10C 74HC4316
R36 10k
C51 10uF
U5C TL084
R53 10k
C52 100pF
R51 10k
J1
PL6-3
PL1-3
C75 N/F
C89 5n6F 10%
17
U1A TL084
R32 10k
C43 47uF
R33 10k
C44 100pF
LK11
R54 10k
LK42
DPLD-WIDE
C109 330nF 25V 20/80%
LK35
R108 10k
U10D 74HC4316
U5A TL084
R40 4k7
R41 4k7
U5B TL084
R45 10k
R46 10k
C50 100pF
R48 10k
R38 10k
R105 4k7
Q5 BC846B
R49 1MO
R39 10k
U1C TL084
R34 10k
C45 47uF
R35 10k
C46 100pF
C54 10uF
15
LK16
LK15
C48 100nF 25V 20/80%
C47 47uF
LK14
LK32
U18 TL084
R37 20R
LK28
AVDD2
VORP
VORM
VOCP
VOCM
VOLP
VOLM
RINM
LINM
VREF
AGND2
AGND1
CV
RR
FR
CHR
RINS
LINS
CHL
FL
RL
AVDD1
TI/O
U7A TL084
R29 10k
R28 10k
C34 3n9F 10%
R27 10k
Q1 BC846B
C37 1nOF
R30 47k
C35 1n5F 10%
C36 220pF
R59 1KO
U7C TL084
R25 10k
R24 10k
C23 3n9F 10%
R23 10k
Q2 BC846B
C38 1nOF
R26 47k
C25 1n5F 10%
C24 220pF
R60 1KO
D3 BAS16
LK27
LK33
C28 3n3F
C29 3n3F
U7B TL084
R21 10k
R20 10k
C20 3n9F 10%
U7D TL084
R19 10k
C39 220pF
R22 47k
C21 1n5F 10%
C22 220pF
LK34
LK38
LK70
LK89
C120 100NF 25V 20/80%
C40 220pF
LK17
PL6-5
PL5-4


3
2
** = Values Subject To Change
+8V
LK120
R87
**
R90
4K7
R93
1KO
U13
5238
R86
**
R94
1KO
LK119
+5VD
PL5-1
C128
100nF
PL5-2
Q13
BC846B
FIXED TO CA
C125
220nF
C126
220nF
R91
10K
-8V
1MO
R95
R96
4K7
R97
4K7
C127
120pF
Q12
BC856B
R92
2K2
R88
**
LK118
GND ON HEATSINK PAD
NOT FITT
+8V
C60
100nF
25V
20/80%
R44
10k
R43
10k
U5D
TL084
R42
4k7
C49
100pF
-8V
R47
10k
LK37
C33
330NF
25V
20/80%
LK52
LK56
LK58
C122
100nF
25V
20/80%
U6
TEA6330T
C17
100uF
C30
33nF
25V
10%
C95
22uF
35V
C91
33nF
25V
10%
C96
330nF
25V
20/80%
U5C
TL084
R53
10k
J1
PL6-3
PL1-3
C75
N/F
C52
100pF
R51
10k
C89
5n6F
10%
LK67
C86
4u7F
50V
20%
C86-MUTE
C93
4u7F
50V
20%
LK68
J2
PL6-2
PL1-2
C92
N/F
C94
5n6F
10%
C93-MUTE
LK66
LK57
LK99
0RO
LK98
0RO
DATA
C66
22uF
35V
20%
LK101
0RO
SCL1SOUND
C109
330nF
25V
20/80%
R40
4k7
R41
4k7
U5B
TL084
R45
10k
R46
10k
C50
100pF
R48
10k
LK51
PWR-MUTE
LK109
LK30
+5VA
U7A
TL084
R29
10k
R28
10k
C34
3n9F
10%
Q1
BC846B
C90
10uF
R27
10k
U10B
74HC4316
LK43
LK103
0RO
R30
47k
C35
1n5F
10%
C36
220pF
R59
1KO
C88
100NF
25V
20/80%
-8V
C100-MUTE
C77
22uF
35V
20%
+5VA
LK9
C104
4u7F
U2C
HEF4053
C124
330nF
25V
20/80%
LK90
J9
0RO
N/F
J10
0RO
D9
BAS19
SPEAKER_SEL
LK45
R83
470K
U7C
TL084
R25
10k
R24
10k
C23
3n9F
10%
Q2
BC846B
C76
10uF
R23
10k
U10A
74HC4316
R26
47k
C25
1n5F
10%
C24
220pF
R60
1KO
C87
100NF
25V
20/80%
-8V
PWR-MUTE
LK107
LK88
+8V
C100
4u7F
50V
20%
C104-MUTE
LK10
C20
3n9F
10%
C62
100nF
25V
20/80%
C97
100uF
C123
100nF
25V
20/80%
C106
22uF
35V
U9
TEA6330T
C98
33nF
25V
10%
C102
33nF
25V
10%
U7B
TL084
R21
10k
R20
10k
U7D
TL084
R19
10k
C110
330nF
25V
20/80%
R22
47k
C21
1n5F
10%
C22
220pF
C101
5n6F
10%
J3
N/F
LK5
LK55
C103
4u7F
C105
5n6F
10%
LK34
LK38
LK70
LK89
-8V
LK100
0RO
LK72
DATA
SCL2SOUND
PL6-5
PL6-4
LK102
0RO
J4


2
1
D
C
B
+8V
LK120
U13
5238
R93
1K0
R94
1K0
LK119
R96
4K7
+5VD
C128
100nF
PL5-1
PL5-2
M
FIXED TO CASE.
Q13
BC846B
R97
4K7
-8V
1M0
R95
C127
120pF
Q12
BC856B
LK118
GND ON HEATSINK PAD.
NOT FITTED
C95
22uF
35V
C91
33nF
C96
330nF
25V
20/80%
25V
10%
C93
4u7F
50V
20%
LK68
J2
PL6-2
PL1-2
LK66
C93-MUTE
LK57
C94
5n6F
10%
C92
N/F
LK99
0R0
LK98
0R0
DATA
LK101
0R0
LK96
0R0
SCL1SOUND
LK51
AMP-SUPP
LK108
C66
22uF
35V
20%
C73
100nF
25V
20/80%
C74
100uF
50V
20%
PL4-2
PL4-1
PL4
2 WAY
FRIC LOCK
C72
2200uF
25V
LK65
C71
100nF
25V
20/80%
R79
3R9
SK1A
SPKR1
Front Right
8W LQR0810-0008M
U11
4280
C67
220UF
25V
20%
PWR-MUTE
LK109
C70
2200uF
25V
LK87
LK114
C69
100nF
25V
20/80%
R78
3R9
LK105
LK92
LK93
C68
220UF
25V
20%
SK1B
SPKR1
Front Left
8W LQR0810-0008M
LK103
0R0
C100-MUTE
+5VA
J9
0R0
N/F
J10
0R0
D9
BAS19
SPEAKER_SEL
U2C
HEF4053
C104
4u7F
C124
330nF
25V
20/80%
LK46
R83
470K
C77
22uF
35V
20%
C84
100nF
25V
20/80%
C85
100uF
50V
20%
LK90
U12
4280
C78
220UF
25V
20%
PWR-MUTE
LK107
C83
2200uF
25V
LK8
C82
100nF
25V
20/80%
R85
3R9
SK1C
SPKR1
8W LQR0810-0008M
C81
2200uF
25V
LK86
LK113
LK7
LK54
C80
100nF
25V
20/80%
R84
3R9
SK1D
SPKR1
8W LQR0810-0008M
C100
4u7F
50V
20%
C104-MUTE
LK10
LK115
0R0
LK116
0R0
C79
220UF
25V
20%
U9
TEA6330T
CPS
IN-R
GND1
CBR1
CBR2
CTP
QRR
VREF
IN-L
VP
CBL1
CBL2
CTL
QLR
QLF
SDA
SCL
C123
100nF
25V
20/80%
C106
22uF
35V
C102
33nF
25V
10%
J3
N/F
LK5
LK55
C103
4u7F
PL1-6
PL6-6
PL6-1
PL1-1
C105
5n6F
10%
LK100
0R0
LK72
DATA
SCL2SOUND


PL2-5
PL8-5
PL2-4
NOISE_SEL
PL8-4
+5VA
PL2-3
PL8-3
PL2-2
DPLD-WIDE
PL8-2
PL2-1
PL8-1
-8V
+8V
C112
100nF
25V
20/80%
C111
2200uF
-8V
C65
25V
100nF
20/80%
C61
2200uF
+5VD
C56
100nF
25V
20/80%
C1
47uF
+5VA
C58
100nF
25V
20/80%
C2
2200uF
C
B
A
U1A
TL084
C43
47uF
C44
100pF
C51
10uF
VREF
R34
10k
U1C
TL084
C45
47uF
R35
10k
C46
100pF
C54
10uF
15
LK16
LK95
LK4
LK14
LK82
LK28
U3
256K 8 BIT
X 32K PS RAM
GND
VCC
I/O3
I/O4
I/O5
I/O6
I/O7
/CE
A10
/OE
A11
A9
A8
A13
/WE
I/O2
I/O1
I/O0
A0
A1
A2
A3
A4
A5
A6
A7
A12
A14
U4
YSS215
D1
D0
A0
A1
A2
A3
A4
DGND1
DGND2
A5
A6
A7
A12
A14
/WE
A13
D2
D3
D4
D5
D6
D7
DVDD1
AVDD2
VORP
VORM
VOCP
VOCM
VOLP
VOLM
RINM
LINM
VREF
AGND2
AGND1
CV
RR
FR
CHR
RINS
LINS
CHL
FL
RL
AVDD1
TI/O
TSBWD
CO
A8
A9
A11
OE
A10
CE
XO
XI
SYNCI
DVDD2
SYNCO
LRS
BCK
WCK
+5VD
C57
100nF
25V
20/80%
C121
100NF
25V
20/80%
D8
BAS16
R4
10k
R2
100R
X1
11.2896MHz
R3
1MO
14
C3
33PF
C4
33PF
C5
100nF
25V
20/80%
C6
4u7F
LK3
LK2
LK25
LK41
SURROUNDCLK
COMMON_CLK
DATA
NOISE_SEL
R82
10k
Q11
BC846B


U4
YSS215
U1A TL084
U1B TL084
U1C TL084
U1D 74HC4316
U5A TL084
U5B TL084
U7A TL084
U7B TL084
U7C TL084
UBA TL084
UBB TL084
UBC TL084
Q5 BC846B
Q11 BC846B
D3 BAS16
D4 BAV99
D5 BAV99
D6 BAV99
D7 BAV99
D8 BAS16
X1 12.896MHz
+5VA
+5VD
VREF
+8V
-8V
DPLD-WIDE
R54 10k
R106 10k
R105 4k7
R34 10k
R35 10k
R37 20R
R38 10k
R39 10k
R40 4k7
R41 4k7
R45 10k
R46 10k
R48 10k
R49 1M0
R29 10k
R28 10k
R27 10k
R30 47k
R25 10k
R24 10k
R23 10k
R26 47k
R21 10k
R20 10k
R19 10k
R22 47k
R64 10k
R63 100R
R55 10k
R56 100R
R65 10k
R66 100R
R57 10k
R58 100R
R82 10k
R2 100R
R3 1M0
R4 10k
C2 2200uF
C43 47uF
C44 100pF
C45 47uF
C46 100pF
C47 47uF
C48 100nF 25V 20/80%
C50 100pF
C51 10uF
C52 100pF
C54 10uF
C109 330nF 25V 20/80%
C34 3n9F 10%
C35 1n5F 10%
C37 1n0F
C23 3n9F 10%
C25 1n5F 10%
C38 1n0F
C20 3n9F 10%
C21 1n5F 10%
C22 220pF
C39 220pF
C28 3n3F
C29 3n3F
C120 100NF 25V 20/80%
C40 220pF
C18 47uF
C19 47uF
C26 10uF
C27 10uF
C10 2n7F
C9 560pF
C63 100nF 25V 20/80%
C13 2n7F
C16 560pF
C121 100NF 25V 20/80%
C4 33PF
C5 100nF 25V 20/80%
C6 4u7F
LK11
LK14
LK15
LK16
LK17
LK25
LK26
LK27
LK28
LK33
LK35
LK41
LK42
LK81
LK82
LK83
15
14



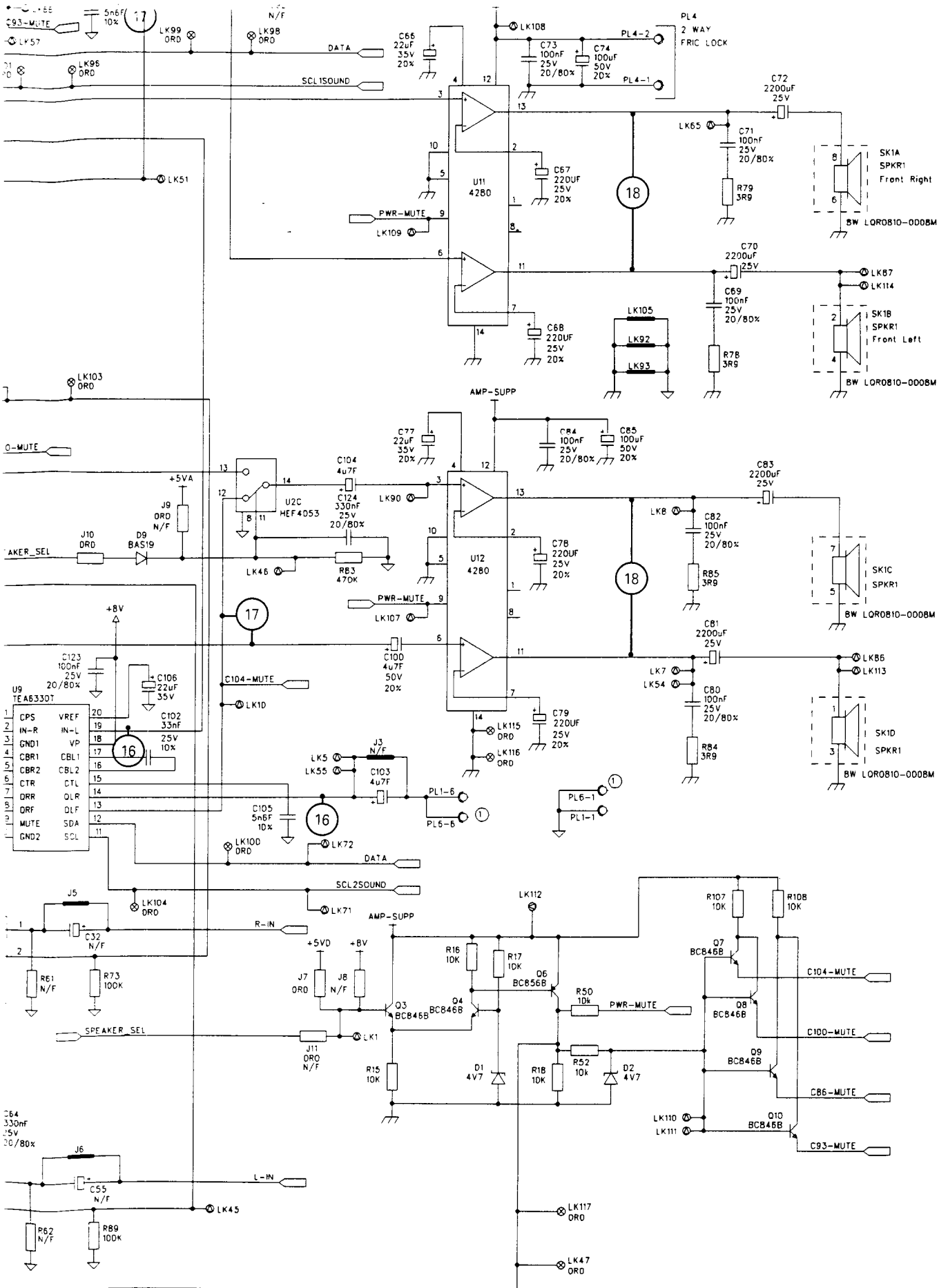
NOTES

N/F = NOT FITTED.
ALL ZENER DIODES 5% UNLESS OTHERWISE STAT
ALL 0805 CAPACITORS 5% 50V UNLESS OTHERW
ALL 0805 RESISTORS 5% 0.1W UNLESS OTHERWI
ALL ELECTROLYTIC CAPACITORS 16V UNLESS OT

⊗ = WIRE LINK IN THE NET.

⊗ = ZERO OHM RESISTOR IN THE NET.

(1) PL6,PL7 AND PL8 ARE FITTED INSTEAD OF PL1,F
RESPECTIVELY FOR PANASONIC VERSION


C
B
A
PL4
2 WAY
FRIC LOCK
U11
4280
U12
4280
U2C
HEF4053
U9
TEA6330T
SK1A
SPKR1
Front Right
SK1B
SPKR1
Front Left
SK1C
SPKR1
SK1D
SPKR1
8W LQR0810-0008M
DATA
SCL1SOUND
SCL2SOUND
PWR-MUTE
AMP-SUPP
C104-MUTE
C100-MUTE
C86-MUTE
C93-MUTE
SPEAKER_SEL
R-IN
L-IN
+5VA
+5VD
+8V
NOTES
N/F = NOT FITTED.
ALL ZENER DIODES 5% UNLESS OTHERWISE STATED.
ALL 0805 CAPACITORS 5% 50V UNLESS OTHERWISE STATED.
ALL 0805 RESISTORS 5% 0.1W UNLESS OTHERWISE STATED.
ALL ELECTROLYTIC CAPACITORS 16V UNLESS OTHERWISE STATED.
= WIRE LINK IN THE NET.
= ZERO OHM RESISTOR IN THE NET.
(1) PL6,PL7 AND PL8 ARE FITTED INSTEAD OF PL1,PL3 AND PL2 RESPECTIVELY FOR PANASONIC VERSION

WARNING

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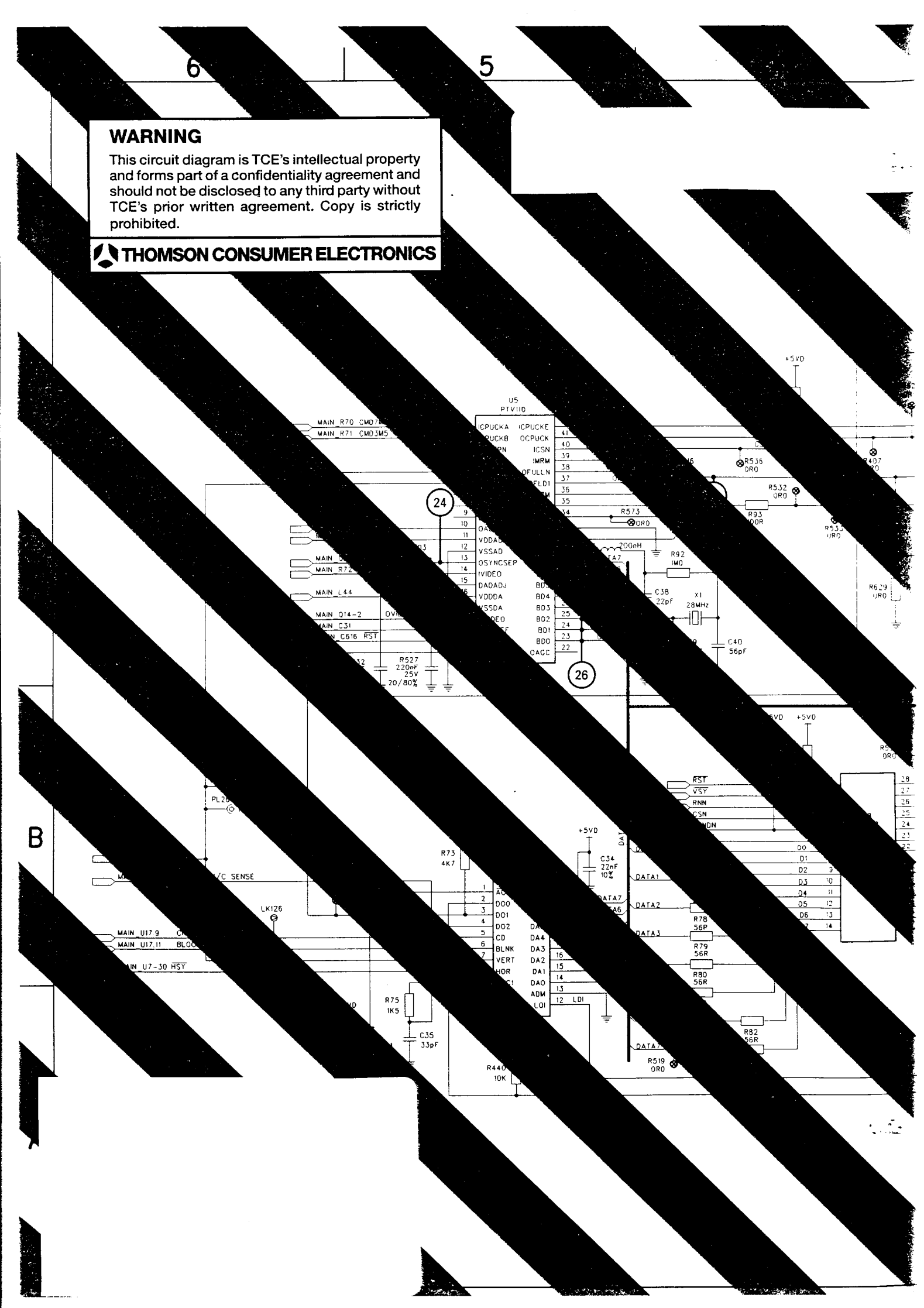
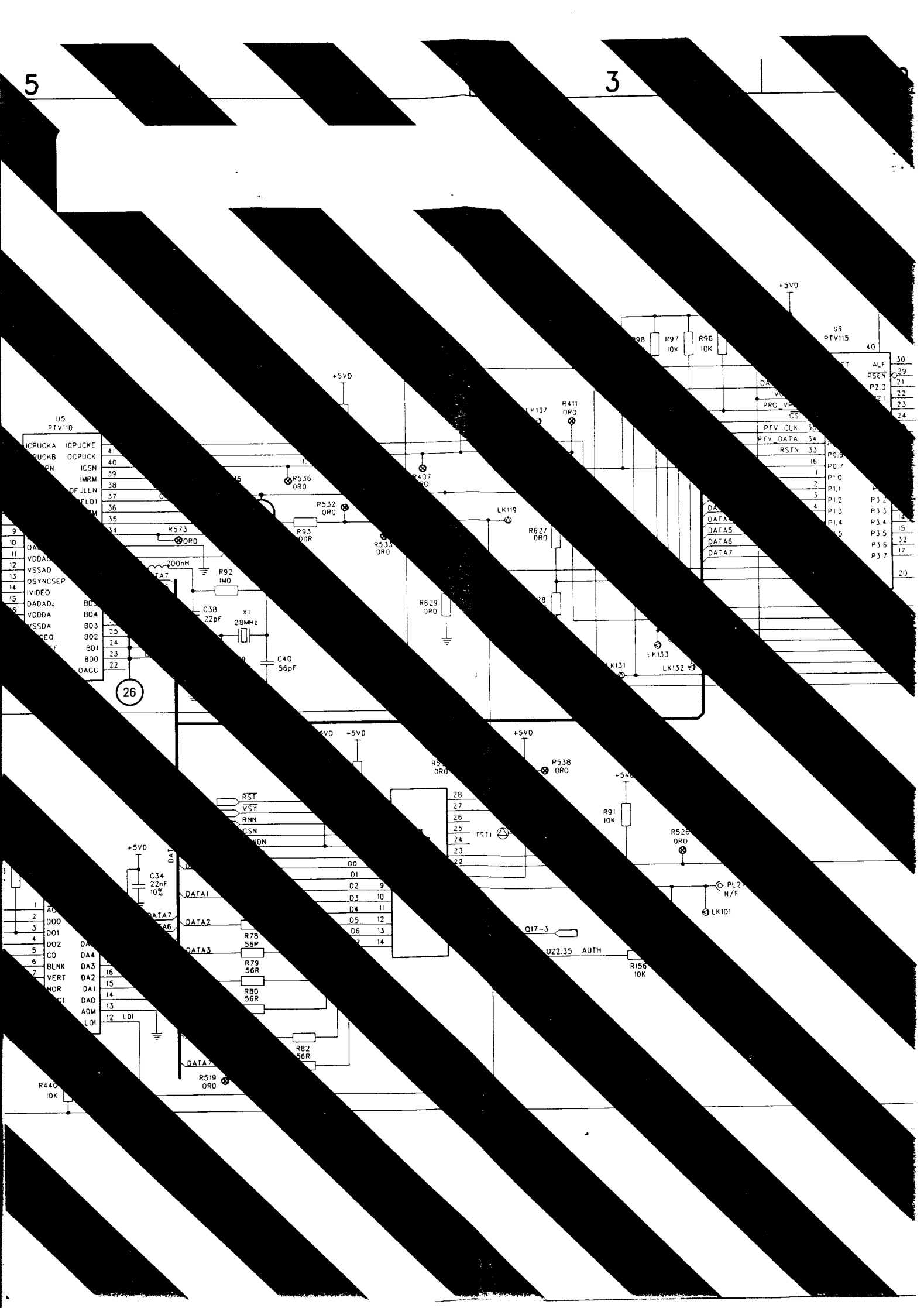
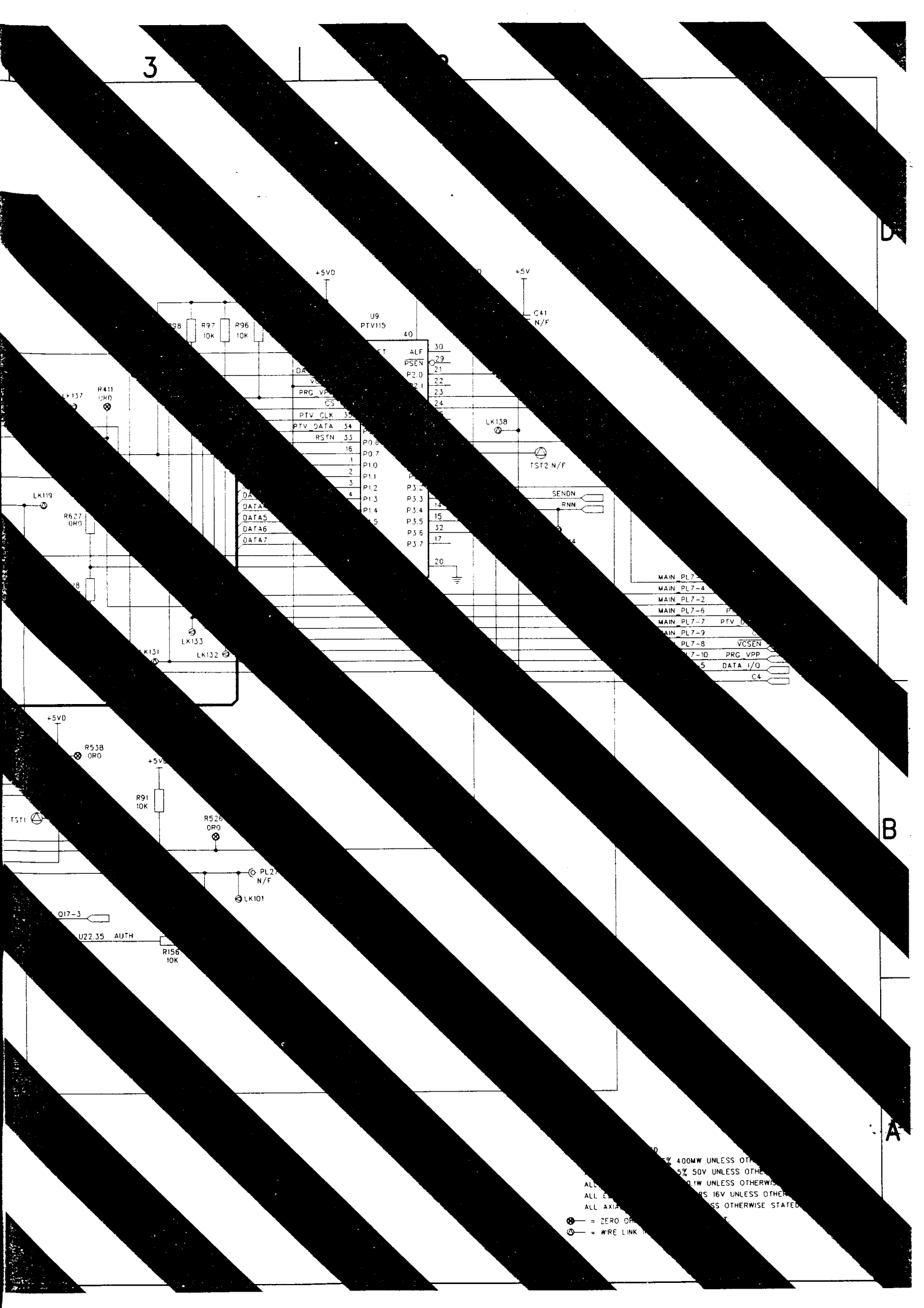
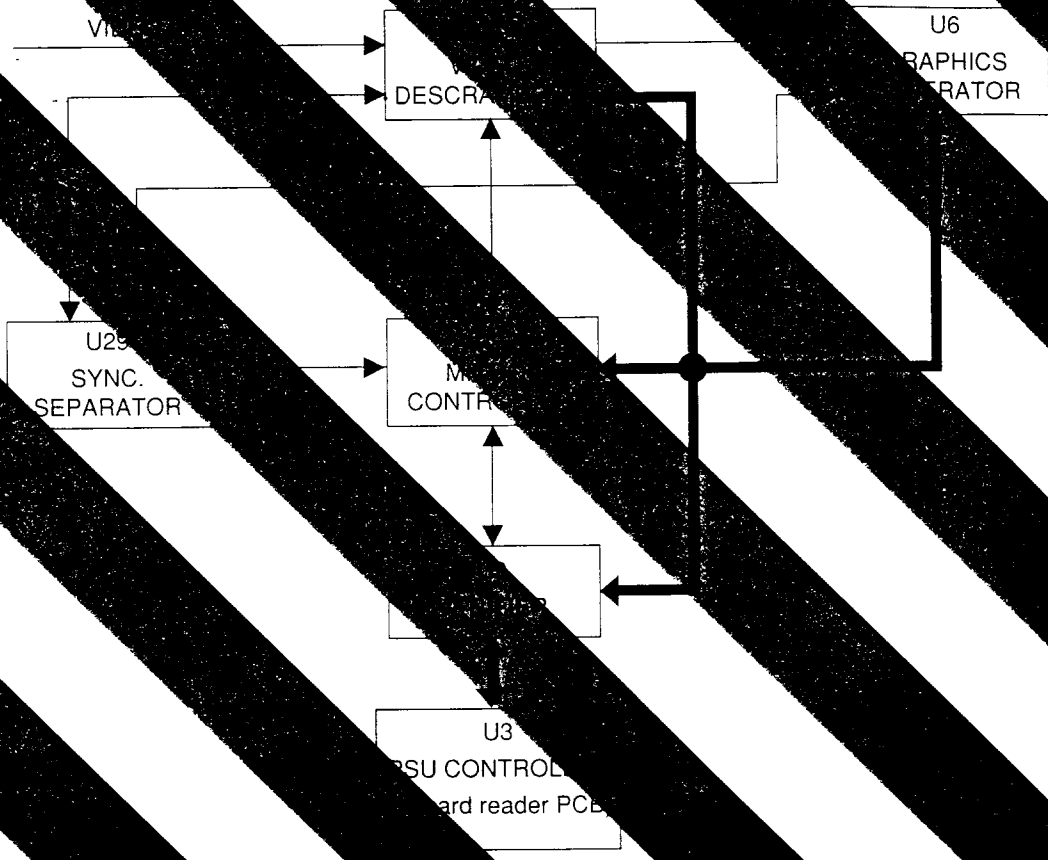
THOMSON CONSUMER ELECTRONICS




5
3
U5
PTV110
U9
PTV115
+5VD
R97
10K
R96
10K
R411
0R0
R536
0R0
R532
0R0
R573
0R0
R92
1M0
200nH
C38
22pF
X1
28MHz
C40
56pF
R627
0R0
R629
0R0
LK119
LK133
LK132
LK131
26
C34
22nF
10%
R78
56R
R79
56R
R80
56R
R82
56R
R519
0R0
R538
0R0
R91
10K
R526
0R0
PL2
N/F
LK101
Q17-3
U22.35
AUTH
R156
10K
R440
10K
DATA1
DATA2
DATA3
DATA7
RST
VST
RNN
FST1


3
+5VD
+5V
U9
PTV115
40
C41
N/F
R98
R97
10K
R96
10K
R411
ORO
LK137
LK138
TST2 N/F
LK119
R627
ORO
SENDN
RNN
DATA5
DATA6
DATA7
PTV_CLK
PTV_DATA
RSTN
PRG_VPP
DATA I/O
VCSEN
LK133
LK131
LK132
R538
ORO
R91
10K
TST1
R526
ORO
LK101
Q17-3
U22.35 AUTH
R156
10K
D
B
A

VIDEOCRYPT BLOCK DIAGRAM AND CIRCUIT DESCRIPTION



main circuit ate sheet) and
(pa ll as the diagra et. The card rea
diagra eparate sheet n is given adja

The vide he energy disp 100 (on the ma
block diagra d at 2 V black le roximately
1.85 V peak-p ar). It is shown belled IVIDEO
the main circu is applied to p U17 (main
t diagram) and in 14 of U5, the mbler (on
oCrypt circuit

signal will only p U17 via pin 1 if
nal, as pins 1 elect between
a ypt signals as escrambling da
vide 4 of U5 is stripp passes down
commo 6, U8 and U9. therefore indic
whether th is scrambled a C SENSE)
emerging fro ndicates this p ence of
crambling to th or U22 (on the iagram).
is a pull-up re of U6. The line t the main
rocessor U22 d a control line port
U25 on the ma am) to pin 10 o If
data was prese itch will pass v
s shown in the iagram. If scra
was the video pass ween pins 1 an
(Note 053 switch, a sh is on page 2
manual.) nal routing afte bed on page 2
the manual.

The video input 5 emerges at p ses via R703,
4, C207, R713 29, the sync. s ses
ic resonator X5 orizontal and ulses. If
valid signal at these sync. p d to
g video signal.

The sync and VSY at pi
are needed cs generator U
also by U6. V by U8, the mic
valid video inpu U29 causes th
7 to go high t locked on to a p
functions in th - see page 2
input at pin 14 ed and des
in 18, where it ely 0.6 V
Q14 into the re lter ar
main m). The signal
Q16 an mponents. R
cies to co e digitisation p
applied to pi R635 (main ch
VideoCrypt grap pins 11 and 9
pins 6 and 5 U6, the Videoc
video signal e in 14 of U17 a
will be switched described a
7 indicates it w scramble

U6 generates d char
the outgoing vi C35
which size of the gra
To operat needs horizon
8 and 7 resp U29.

U9 is a verifier ls the data and
der via the card controller U3
m). There is a pin 3 of U6 (R
ters U9 at pin 9 during a po
ck is controlled MHz oscil
7 MHz and 3.5 requ
U9 (e card reader MH

GRID REFERENCES FOR VID

* = not fitted
° = actually a capacitor (in a resistor position)

CAPACITORS

C32	C5
C34	B5
C35	A5
C38	C4
C39	C4
C40	C4
C41*	D2
C591	A5
C604	A5

INDUCTORS

L5	C4
L35	C5
L36	C4

LINKS

LK60	B6
LK84	B6
LK100	B6
LK101	B3
LK110	C2
LK114	C2
LK116	C3
LK119	C3
LK124	B6
LK126	B6
LK129	C3
LK130	C3
LK131	C3
LK132	C3
LK133	C3
LK135	C2
LK137	C3
LK138	C2
LK156	B6

CONNECTORS

PL26-1*	C6
PL26-2*	B6
PL26-5*	B5
PL27*	B3

TRANSISTORS

Q29	B3

RESISTORS

R73	B5
R75	A5
R76	B4
R77	B4
R78	B4
R79	B4
R80	B4
R81	A4
R82	A4
R83	A4
R88	B4
R89	B4
R90	B3
R91	B3
R92	C4
R93	C4
R94	C4
R95	D3
R96	D3
R97	D3
R98	D3
R99	D3
R100	C4
R101	C4
R102	D2
R156	B3
R407	C4
R411	C3
R413	C2
R414	B6
R416	C4
R440	A5
R519	A4
R524	A4
R526	B3
R527°	C5
R528	A4
R529	C4
R530	C3
R532	C4
R533	C4
R536	C4

CARD READER DESCRIPTIO

Please see the circuit diagram for the ca

Most of the signals pass between the ca on the main board and PL1 on the card r the ribbon cable between PL12 on the m

All the signals to the two card readers ar processor U22 (on the main board) via th 4053 switches; a diagram is given on pa

The 3.5 MHz clock to the cards (C3CLK) line C4 is not used.

When a card is inserted into card reader 14 of U2 (which is under the control of th presence of a card (the CD_DET line). F

The CD_DET line can also be pulled low (pin 27) and Q74 (see the main board ci card 1 and card 2 (either under user con change of card) and ensures that the sw

If U3 on the card reader board detects th (VideoCrypt circuit diagram) determines commands U3 to apply power (VCC and

For card 1, VCC goes to 5 V and is appli U1 (pins 2 and 1 of U1 determine wheth 5 V and this passes to card 1 via Q8, wh turned on until Q4 is conducting VCC, so

For card 2, VCC goes to 5 V and is appli U1. VPP is also initially 5 V and this pass components. Q5 cannot be turned on un

Data and clock should also be present at provide protection for the control lines RS

GRID REFERENCES FOR VIDEOCRYPT CIRCUIT DIAGRAM

* = not fitted
° = actually a capacitor (in a resistor position)

CAPACITORS

C32	C5
C34	B5
C35	A5
C38	C4
C39	C4
C40	C4
C41*	D2
C591	A5
C604	A5

INDUCTORS

L5	C4
L35	C5
L36	C4

LINKS

LK60	B6
LK84	B6
LK100	B6
LK101	B3
LK110	C2
LK114	C2
LK116	C3
LK119	C3
LK124	B6
LK126	B6
LK129	C3
LK130	C3
LK131	C3
LK132	C3
LK133	C3
LK135	C2
LK137	C3
LK138	C2
LK156	B6

CONNECTORS

PL26-1*	C6
PL26-2*	B6
PL26-5*	B5
PL27*	B3

TRANSISTORS

Q29	B3

RESISTORS

R73	B5
R75	A5
R76	B4
R77	B4
R78	B4
R79	B4
R80	B4
R81	A4
R82	A4
R83	A4
R88	B4
R89	B4
R90	B3
R91	B3
R92	C4
R93	C4
R94	C4
R95	D3
R96	D3
R97	D3
R98	D3
R99	D3
R100	C4
R101	C4
R102	D2
R156	B3
R407	C4
R411	C3
R413	C2
R414	B6
R416	C4
R440	A5
R519	A4
R524	A4
R526	B3
R527°	C5
R528	A4
R529	C4
R530	C3
R532	C4
R533	C4
R536	C4
R537	B4
R538	B3
R573	C5
R627	C3
R628*	C3
R629	C4
R630*	C4
R703	C5

ICS

U5	C5
U6	B5
U8	B4
U9	C2

MISC. COMPONENTS

TST1	B3
TST2*	C2
X1	C4

INTERCONNECTIONS

(WITHIN THIS CIRCUIT)	
CMD3M5	C2, C6
CMD7M	C2, C6
CSN	B4, C4
HSY	B6, C6
OFLD1	B4, C4
OFULLN	B3, C4
RNN	B4, C2, C4
RST	B4, C6
SENDN	B4, C2
VSY	B4, B6

(TO MAIN CIRCUITRY)	
MAIN_C30 (VREF)	C6
MAIN_C31	C6
MAIN_C616 (RST)	C6
MAIN_L43	C6
MAIN_L44	C6
MAIN_PL7-1 (C4)	C1
MAIN_PL7-2 (C3CLK)	C1
MAIN_PL7-3 (IRQ)	C1
MAIN_PL7-4 (RSTN)	C1
MAIN_PL7-5 (DATA-I/O)	C1
MAIN_PL7-6 (PTV-CLK)	C1
MAIN_PL7-7 (PTV-DATA)	C1
MAIN_PL7-8 (VCSEN)	C1
MAIN_PL7-9 (CS)	C1
MAIN_PL7-10 (PRG-VPP)	C1
MAIN_Q14-2 (OVIDEO)	C6
MAIN_Q17-3	B3
MAIN_Q64-2 (OSYNCSEP)	C6
MAIN_R72 (IVIDEO)	C6
MAIN_U7.30 (HSY)	B6
MAIN_U7.31 (VSY)	B6
MAIN_U17.9 (CHAR)	B6
MAIN_U17.11 (BLOCK)	B6
MAIN_U22.16 (V/C SENSE)	B6
MAIN_U22.35 (AUTH)	B3

CARD READER DESCRIPTION (CARD READER PCB)

Please see the circuit diagram for the card reader board on the separate sheet.

Most of the signals pass between the card reader board and main board via a ribbon cable between PL7 on the main board and PL1 on the card reader board. The control lines CARDSEL1 and CD_DET enter via the ribbon cable between PL12 on the main board and PL2 on the card reader board.

All the signals to the two card readers are multplexed by ICs U1 and U2, under the control of the microprocessor U22 (on the main board) via the CARDSEL1 line from pin 26 of U22. Note that U1 and U2 are 4053 switches; a diagram is given on page 21 of the manual.

The 3.5 MHz clock to the cards (C3CLK) is buffered by U4B before being applied to the cards by U1. The line C4 is not used.

When a card is inserted into card reader 1, the card switch is opened and a signal goes via pin 12 and pin 14 of U2 (which is under the control of the CARDSEL1 line). This pulls pin 17 of U3 high to indicate the presence of a card (the CD_DET line). For card reader 2 the signal goes via pin 13 and pin 14 of U2.

The CD_DET line can also be pulled low for a short duration (approx. 4 ms) by the microprocessor U22 (pin 27) and Q74 (see the main board circuit diagram). This only occurs when there is switching between card 1 and card 2 (either under user control at the Card Menu or when a change of programme causes a change of card) and ensures that the switching is done correctly.

If U3 on the card reader board detects the presence of a card and verifier U9 on the main board (VideoCrypt circuit diagram) determines that the card needs to be addressed, then a data line from U9 commands U3 to apply power (VCC and VPP) to the card.

For card 1, VCC goes to 5 V and is applied via Q4 to the card. Q4 is switched via R6, R39, Q2 and pin 2 of U1 (pins 2 and 1 of U1 determine whether card 1 or card 2 respectively receives VCC). VPP is also initially 5 V and this passes to card 1 via Q8, which is switched by Q7 and associated components. Q7 cannot be turned on until Q4 is conducting VCC, so VPP cannot be at the card unless VCC is also present.

For card 2, VCC goes to 5 V and is applied via Q3 to the card. Q3 is switched via R7, R37, Q1 and pin 1 of U1. VPP is also initially 5 V and this passes to card 2 via Q6, which is switched by Q5 and associated components. Q5 cannot be turned on until Q3 is conducting VCC.

Data and clock should also be present at the cards before communication can take place. Diodes D1 to D8 provide protection for the control lines RSTN, DATA I/O, C3CLK and C4 to keep them in the range 0 to 5 V.

The microprocessor U1 checks to see whether the front panel switches are open or closed as follows. It sets pin 5 low (and therefore pin 6 high) momentarily and checks whether pin 14 is high or low. If it is low, then SW3 (the programme selector button) must be closed; if it is high then SW3 must be open. While pin 5 is still low, U1 then checks whether pin 8 is high or low. If it is low then SW4 (the surround sound button) must be closed; if it is high then SW4 must be open. To check the other two switches, U1 then sets pin 6 low (and therefore pin 5 high) momentarily and checks again whether pin 14 is high or low. If it is low, then SW1 (the volume button) must be closed; if it is high then SW1 must be open. While pin 6 is still low, U1 then checks whether pin 8 is high or low. If it is low then SW2 (the standby button) must be closed; if it is high then SW2 must be open.

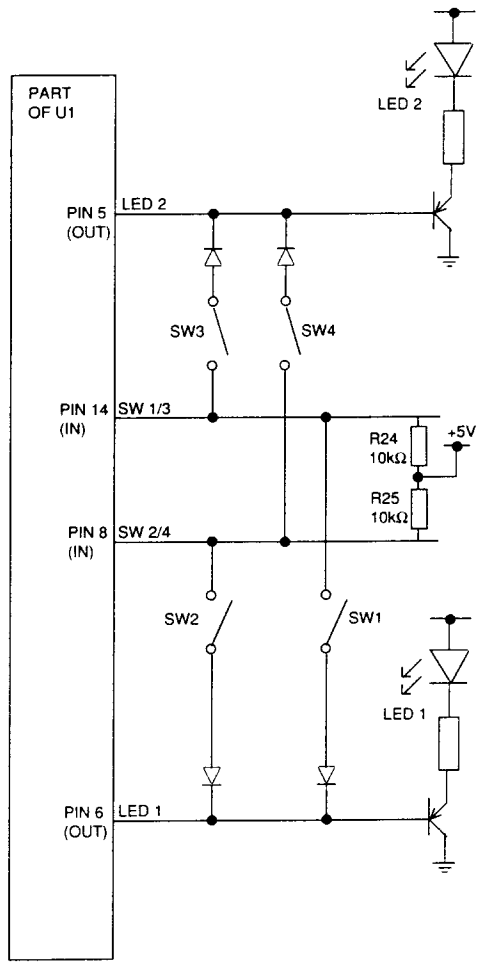
This checking of the switches is done very quickly, so that if an LED is extinguished, the very quick switch-on when a pin goes high is not noticeable to the eye (or if the LED is illuminated, a very quick switch-off when a pin goes low is not noticed).

If SW2 is detected as being closed, U1 sets both pins 5 and 6 low (except for the short time during which it does the checks) so that both LEDs extinguish and U1 causes the word "Standby" to be illuminated on the VFD.

If SW3 is closed then U1 sets pin 5 high and pin 6 low (except for the short time during which it does the checks) so that only LED 2 is illuminated. If SW1 is closed then U1 sets pin 6 high and pin 5 low (except for the short time during which it does the checks), so that only LED 1 is illuminated.

The closing and opening of SW4 causes a stepping through the four sound modes for home cinema effects. U1 keeps track of which sound mode is currently applied and steps to the next in the sequence if a change in SW4 is detected.

The presence of the diodes D1, D2, D3 and D4 prevent LED 1 and LED 2 illuminating simultaneously if the buttons are pressed simultaneously.



Front Panel Dial

This is a digital rotary potentiometer (SW5) which has a common 5 V supply and two outputs which each have a 10 kΩ pull-down resistor (R15, R16). As the potentiometer is rotated clockwise (right) or anti-clockwise (left), there are 5 V pulses to pins 9 and 10 of U1. The sequence of these pulses is decoded by U1 and sent to the microprocessor U22 on the main board (which in turn controls the tuning or volume control circuitry).

Vacuum Fluorescent Display

The supply to the VFD is FP_FILAMENT which comes from the 22 kHz oscillator supply on the main PCB via the ribbon cable between PL1 on the display board and PL2 on the main board. It is AC coupled via C22 and drives transistors Q5 and Q6, which act as a push-pull pair. This provides an 8 V peak-peak square wave (50% mark to space ratio) which is then AC coupled via C2 and drives the filament wires within the VFD (these can be seen as thin horizontal wires across the front of the display). The resistors R32, R1, R33, R34 and R2 hold the filament wires at a particular DC level.

The supplied current to the filament wires cause them to heat up and emit positive barium ions. When a segment of the display is turned on (by the application of a negative voltage) the segment attracts the barium ions which strike the phosphor coating in the VFD causing it to glow in the applicable segment. The negative voltage applied to cause illumination is -21 V; the segments are at 5 V when they are extinguished.

The microprocessor U1 controls all of the multiplexing of the lines to the VFD and therefore which segments illuminate at any given instant. Q1, Q2, Q3, Q4 and Q7 are buffer drivers. The illumination of each particular part of the display is controlled by a "grid" line and a "segment" line. The display is divided into 11 grids, grids 1 to 10 being the characters of the 10-character display (starting at the right-hand side) and grid 11 being the rest of the display, as shown in the diagram at the bottom of the page. Each grid is then divided into 35 segments, as shown in the separate diagram of a single character. Each part (generally each word) of grid 11 is a segment.

If you notice a fault in the display, the diagrams allow you to see which grid or segment is affected and therefore which of the tracks on the display PCB should be checked for breaks or shorts. The table (right) cross-references the grid and segment numbers with the pins on the VFD and on U1. There is also a self test sequence for the VFD.

Grid No.	VFD Pin	U1 Pin
1	4	47
2	5	36
3	6	37
4	7	38
5	8	39
6	9	56
7	10	64
8	11	1
9	12	2
10	13	3
11	14	7
Seg. No.	**VFD Pin**	**U1 Pin**
1	28	16
2	29	17
3	30	18
4	27	19
5	26	20
6	25	21
7	24	22
8	23	23
9	22	48
10	21	49
11	20	50
12	19	51
13	18	52
14	17	53
15	16	54
16	15	55
17	31	24
18	32	25
19	33	26
20	34	27
21	35	28
22	36	29
23	37	30
24	38	31
25	39	32
26	40	33
27	41	34
28	42	35
29	43	40
30	44	41
31	45	42
32	46	43
33	47	44
34	48	45
35, 36	49	46

Self Test

To start the test, display the Main Menu then quickly press F, 6, STORE.

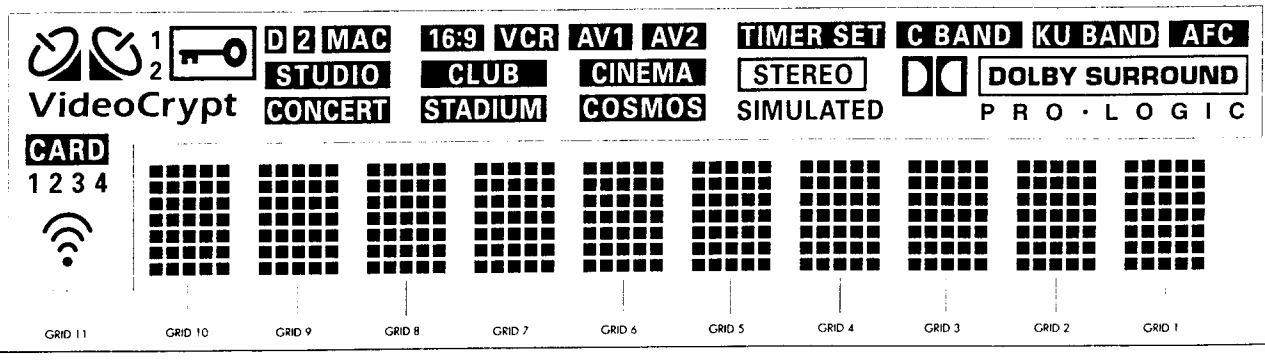
The display then illuminates in the following sequence:

- the words "SELF TEST" are displayed;
- the software number is displayed;
- all the grids and segments are illuminated simultaneously;
- each segment is displayed in turn in the form of the word "SEG" followed by a number, alongside which a dot illuminates for each segment in turn (as in the diagram below);
- each grid illuminates in turn;
- the words "ROTARY 00" are displayed, at which point you should turn the front panel dial, first in one direction and then in the opposite direction (positive or negative numbers are displayed after the word "ROTARY" to indicate correct operation);
- the word "PRESS SW10" is displayed, at which point you should press the VOLUME switch (SW1) several times to check it is operating correctly (sequential numbers after the "1" on the display indicate this);
- the preceding step is repeated for each front panel switch in turn (i.e. SW2 is STANDBY, SW3 is PROGRAMME SELECTOR and SW4 is SURROUND SOUND) and for each you should press the appropriate switch several times to test it.

At the end of this test sequence the message "TEST END" is displayed and the self test keeps repeating until you press the NORM key to return to normal viewing mode.

1	2	3	4	5
6	7	8	9	10
11	12	13	14	15
16	17	18	19	20
21	22	23	24	25
26	27	28	29	30
31	32	33	34	35

Segment numbers for grids 1 to 10



U22 Extension PCB

The main component in the control circuitry is U22 which is based on the Z8 microprocessor. In some receivers U22 is a custom-masked single component, but in some receivers it could be a small extension board containing a standard microprocessor and a separate ROM. This extension board contains six capacitors (C1, C2, C3, C4, C5 and C6), three ICs (U1, U3 and U4) and 16 MHz crystal X1. The circuit and component ident diagrams for this board are given adjacent; a parts list is given at the end of this manual. Note that the C3, C4, C5, C6, U1, U3 and U4 in this list are quite different from the components with those names which are on the main PCB. When the extension board is replaced by the custom-masked U22, X1 is moved to the main PCB as X3, C5 is moved to become C150 and C6 is moved to become C151.

U22 Functionality

U22 runs with a 16 MHz clock generated by crystal X3 and performs the following functions:

- it decodes the information received form U1, the microprocessor on the display board, (U1 has already processed data from the handset and from the front panel buttons and dial);
- it generates the control signals for the on-screen graphics;
- it controls the frequency synthesis loops for the tuner and for the UHF modulator;
- it controls the routing of the video and audio signals;
- it controls other switching functions such as the LNB supply switching;
- in conjunction with U1 on the display board, it activates the front panel vacuum fluorescent display.

U27 is an E^2PROM which is used to store information which is set at the on-screen menus. U25 is a shift register which acts as a port expander for U22.

Control Lines

A block diagram of the I^2C control lines is shown adjacent. Some of U22's control functions occur via the DATA line; others have specific control lines which are described at the relevant points in the circuit descriptions. Some lines (e.g. STATION_ID, LNB_SHORT) are inputs to U22 to inform it of conditions arising in the hardware. The lines AUXSTAT and DEC_STAT are inputs which inform U22 that pin 8 of the AV1 (AUX) SCART and AV2 (DEC) SCART respectively have gone high. As described on page 23, the line VCRSTAT can be an input or an output at U22 and it is this which controls pin 8 of the TV SCART. The TVSTAT line is always an output from U22 and is described on page 22.

Sometimes control lines arise in other parts of the circuitry, examples are NOISE_SEL line from pin 5 of U18 in the audio circuitry (see page 33) and the various MUTE lines in the sound board circuitry (see page 35).

Reset

A reset is applied to all the microprocessors within the unit (i.e. U22, U18, U1 on the display board, U5 and U8 in the VideoCrypt circuitry) when the +5 V supply falls to approx. 4 V. Transistor Q110, which is only just turned on at the full 5 V, switches off when the supply drops. This switches Q111 on which shorts out the reset capacitor C594 and applies the reset to the microprocessors. If the reset line (RST) is low Q115 and Q114 also switch off; this removes the VPP voltage from the card reader board.

AUDIO PROCESSING (MAIN BOARD)

Please see the main circuit diagram and the adjacent audio block diagram.

Demodulation, De-emphasis and Panda Noise Reduction

All of these functions are carried out by the audio processor IC U18. A band pass filter of frequency range 5 - 9 MHz (comprising Q104 and associated components) filters the baseband signal from pin 13 of the tuner. The filtered signal then enters the audio processor U18 at pin 58 and is digitised. All functions are then carried out digitally within the chip, under the control of the main microprocessor U22. The audio processor has two independent digital oscillators to tune the audio subcarriers independently.

SCART Input Selection

U18, in association with the switch U20, routes the audio signals which enter the receiver at the SCART connectors. They are also routed through to the sound board so that home cinema effects can be applied to them. The VCR and AV2 (DEC) audio inputs go directly to the audio processor and are digitised for input pre-processing. The AV1 (AUX) and TV inputs go through the switch U20 before being digitised by U18. The switch is controlled by the line AV/AUDIO from pin 13 of port expander U25. These incoming signals are digitised so that volume, treble and bass adjustments can be carried out on them.

There is also a 7 line path which routes the incoming signals from the SCARTs (and the input at pin 55 of U18 - see below) directly through U18 if they require no adjustment. Note that the audio signal from the tuner is always routed through U18 via the digital path.

The following are input decoupling capacitors: C143 and C144 (for AV2 (DEC) SCART), C139 and C140 (for AV1 (AUX) SCART), C141 and C142 (for TV SCART) and C132 and C133 (for VCR SCART). The capacitor ends connected to U18 should have a DC bias of approx. 3.8 V.

Input from Sound Board

There is an input to U18 at pin 55 which comes from the sound board via PL1 pin 6 and decoupling capacitor C601. This is the path for the centre channel for all speaker configurations except Configuration 4 (when it is the sum of the right total R_T and left total L_T channels). For Configuration 2 the **centre** channel emerges from U18 at pins 33 and 34 to be routed to the UHF modulator. For Configuration 4 the **sum** of R_T and L_T emerges at both pins. For Configurations 1 and 3 R_T emerges at 33 and L_T at 34, but note that in this case R_T and L_T have not been routed via the sound board. See also page 32.

Audio Processor - Peripheral Components and Control Lines

Audio processor U18 needs various peripheral components to function correctly:

- X2, C113 and C114 (on pins 62 and 63) form the crystal oscillator circuit which runs at 18.432 MHz;
- C115, C116 (on pins 43 and 44) are filter capacitors for the SCART A/D;
- C117, C118 (on pin 42) are filter capacitors for the internal analogue voltage reference;
- C111, C112 (on pin 54) are filter capacitors for the audio baseband A/D;
- C122, C123 (on pins 40 and 38) are filter capacitors for the volume control D/A and for the AV D/A;
- C120, C121 (on pins 31 and 32) are filter capacitors for the SCART D/A;
- filter capacitors for the power supplies as follows: C108 (+5 V analogue on pin 57), C119 and C252 (+8 V on pin 39 to 41), C147 and C148 (+5 V digital on pin 18 to 19), C253 (+5 V digital on pin 6 to 7);
- D38 and R210 form a voltage regulator to convert +12 V to 8 V at pin 39.

Control/bus links to/from the audio processor are:

- pin 9 is the I^2C bus clock to pin 10 of the main control microprocessor U22;
- pin 10 is the I^2C bus data which connects to pin 37 of U22;
- pin 5 controls the noise sequencing selection for the Dolby Pro Logic Decoder (U4 on the sound board);
- pin 4 can disable the switch U30 to mute the audio signal to the TV SCART.

Audio Baseband Processing and Signal Routing

The digital field processor in U18 and the op. amp. U19 process all the audio baseband signals and perform signal routing with the aid of U30 and U20.

Digital Signal Processing comprises:

- input pre-processing;
- audio mode selection (Stereo A to D, Mono 1 to 9, or customised mode, as selected at the Audio Menu);
- audio mode post-processing.

All of the above processing changes depend on a combination of the following:

- the speaker configuration set at the Speaker Configuration Menu (see also the later section entitled "TV SCART Output");
- the operation of the TV/SAT key (for switching between satellite, terrestrial and VCR - pin 8 of TV SCART and pin 29 of VCR SCART);
- the activity of the DEC status (pin 8 of SK3 = pin 8 of AV2 SCART) and the AV1 (AUX) status (pin 29 of SK3 = pin 8 of AV1 SCART) (can be controlled by the 0 (AV) key for switching between AV1, AV2 and satellite).

Dolby Pro Logic Input

The audio input to the Dolby Pro Logic Decoder (U4 on the sound board) can be any of the following:-

- FM SAT (frequency modulated satellite signal - i.e. analogue audio as in PAL, SECAM etc.);
- VCR (audio from VCR - i.e. when "VCR Play" or "VCR → AV" is displayed on the receiver's front panel);
- TV (audio from terrestrial TV - i.e. when "TV → AV" is on the front panel display);
- AUX (AV1) (audio from equipment connected to the AV1 SCART - i.e. when "AV1" is displayed on the front panel);
- DEC (AV2) (audio from equipment connected to the AV2 SCART - i.e. when "AV2" is displayed on the front panel).

These signals emerge from pins 28 and 29 of U18 and are then amplified before going to the Dolby Pro Logic Decoder (via ribbon cable between connectors PL4 on the main board and PL2 on the sound board) and to the TV Scart (via switch U30). The amplifier has a gain of 1.5 and consists of U19 (A & D), R640, R641, R643, R644. Capacitors C213, C214, C507, C509 and resistors R642, R639 couple the signals from the audio processor U18 to the amplifier U19 (A & D).

AV1/AV2 SCART Output

This signal is always FM SAT (L_T and R_T). Note that the AV1 (AUX) and AV2 (DEC) SCARTS are auxiliary inputs and decoder outputs. Audio and video can be inputs, but only the audio from the satellite signals and baseband video are output, so if you were to attach a VCR to these SCARTs you could record the satellite audio, but not the video correctly.

C145, R398 (for right channel) and C146, R399 (for left channel) couple the signals from pins 25 and 26 respectively of the audio processor U18 to the AUX (AV1) and DEC (AV2) SCART connectors.

VCR SCART Output

This signal can be any one of the following:

- FM SAT (L_T and R_T)
- AUX (AV1) (L_T and R_T)
- DEC (AV2) (L_T and R_T)

C134, R396 (for right channel) and C135, R397 (for left) couple the signals from pins 36 and 37 respectively of the audio processor U18 to the VCR SCART.

UHF Audio Output

This signal can be either:

- FM SAT (L_T and R_T), or
- the centre channel of any of the audio sources that go to the Dolby Pro Logic Decoder (see also the earlier section entitled "Input from Sound Board").

The selection of Configuration 2 at the Speaker Configuration Menu causes the centre channel from the sound board to emerge from pins 33 and 34 of U18; this has implications for recording on a UHF-connected VCR (see the table below). For Configurations 1 and 3, R_T and L_T from the digital field processor in U18 emerge at pins 33 and 34 respectively.

When the receiver is in Configuration 4 (i.e. you cannot apply home cinema effects) the audio still needs to be routed via the sound board to reach the UHF modulator. In Configuration 4, R_T and L_T at pins 28 and 29 of U18 pass to U4 on the sound board where they are added together and put onto the path which (for the other configurations) is used by the centre channel. In this configuration the left, right and surround channels are muted and the "$R_T + L_T$" channel is set to a preset volume. The volume is therefore controlled by U18 (i.e. you can use the receiver handset to change the "UHF" volume). $R_T + L_T$ passes back to the main board via PL1 to enter U18 at pin 55. $R_T + L_T$ emerges at both pin 33 and pin 34.

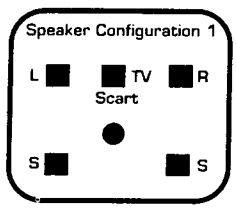
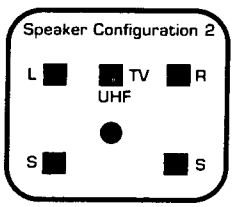
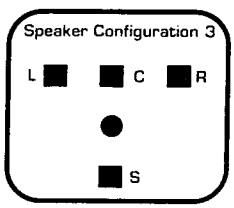
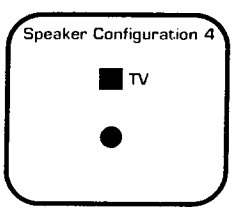
In all configurations the signals emerging at pins 33 and 34 are combined and pre-emphasised by U19C and associated components to give a mono signal.

TV SCART Output

The signal routing to the TV SCART connector is performed by U30. Any of the following audio sources can be routed to the TV SCART:

- FM SAT
- VCR
- TV
- AUX (AV1)
- DEC (AV2)

The actual signals derived from these sources depend on the configuration set at the Speaker Configuration Menu (i.e. is controlled by the SPEAKER_SEL line from pin 24 of microprocessor U22). U30 is a 4053 switch; see also page 21.

Configuration	Audio to TV SCART	Audio to UHF	Comments
	Centre channel from Dolby Pro Logic Decoder	Left total (L_T) and right total (R_T) directly from the audio processor U18.	To get audio (L_T and R_T) to a UHF splitter or to a UHF-connected VCR, **and at the same time** to hear the effects properly on the TV, (i.e. centre channel from TV), this configuration must be used, and the TV must also be connected by a SCART lead.
	Centre channel from Dolby Pro Logic Decoder	Centre channel from Dolby Pro Logic Decoder	
	Muted (the switch U30 is disabled in this case, under control from pin 4 of U18)	Left total (L_T) and right total (R_T) directly from the audio processor U18.	Because U30 is disabled, no **video** signals from a SCART-connected VCR can reach the TV, if the TV is UHF-connected (there is a by-pass to allow satellite video signals to reach the TV). Note that audio from the VCR can still be heard. See also page 23.
	Left total (L_T) and right total (R_T) from the audio processor U18, via U30. (Volume, bass and treble are also controlled from U18 in this case).	Left total (L_T) and right total (R_T) from the audio processor U18, passed via the sound board, as described near the top of this page.	

AUDIO PROCESSING (SOUND BOARD)

Please see the circuit diagram for the sound board and the audio block diagram on page 30. Details of sound board operation when the receiver is in Speaker Configuration 4 are given near the top of page 32.

Detection of the Sound Board

The main microprocessor U22 detects the presence of the sound board by communicating with the volume control ICs U6 and U9 via the audio I²C BUS on pins 11 and 12 of U6 and U9. This communication is via a ribbon cable between PL3 on the main board and PL3 on the sound board. If this link is broken or if U6 and U9 are not powered or not functioning, then the main microprocessor will not detect them and you cannot access the Surround Menu and its sub-menus.

Input to the Sound Processor

The sound processor U4 performs Dolby Pro Logic decoding and digital sound processing (sound field simulation). The left total and right total signals are routed from the audio-processor U18 (on the main board) via a ribbon cable between PL4 on the main board and PL2 on the sound board. On the sound board they are routed via switch U2A (for the left channel) and U2B (for the right channel).

The signals are then split into two paths as follows.

- The signal to be applied to the analogue inputs is routed directly into the sound processor at pins 18 and 17 after being centred in the digitising window at approximately 2.5 volts by C18, R64 (for right channel) and C19, R65 (for left channel). Input protection for the A/D converters inside U4 is provided by D6, R63 (for right) and D7, R66 (for left).
- The signal to be applied to the digital inputs is filtered by a 5th order low pass filter to prevent aliasing. The filter comprises U8B,D (for right) and U8A,C (for left) and associated components and has a bandwidth of 13 kHz. The audio signals are then centred in the digitising window by C26, R55 (for right) and C27, R57 (for left) and digitised at a sampling frequency of 44.1 kHz. D4, R56 (for right) and D5, R58 (for left) are input protection for the A/D converters inside the sound processor.

In the audio block diagram, the switch U2A and U2B is shown passing the left total and right total signals. This occurs when the noise control line (NOISE_SEL from pin 5 of the audio processor U18 on the main board) is high. If this control line is low, the noise sequencer feedback path is closed (which is the situation when the cyclic noise test at the Speaker Levels Menu is "on") - this is the condition shown in the sound board circuit diagram. See also the later section entitled "Noise Sequencer".

Sound Processor - Peripheral Components and Control Lines

The sound processor U4 has various necessary peripheral components:

- X1, R2, C3 and C4 (on pins 55, 56) form an 11.2896 MHz oscillator circuit;
- R4, R82, C5, C6, D8 and Q11 (on pin 60) form the reset circuit which should be approximately 5 V during normal operation;
- U3 is a 32K by 8 pseudo-static RAM which stores the digitised audio signals and enables U4 to create the sound field simulation (for the "simulated" sound mode), time delay (as required at the Listening Position Menu) and the noise sequencer (as required at the Speaker Levels Menu);
- filter capacitors for the power supplies as follows: C121 (+5 V digital on pins 2. 3, 57, 58), C1, C56 (+5 V digital on pin 26), C120 (+5 V analogue on pin 4) and C2, C58 (+5 V analogue on pin 25);

The sound processor, in association with buffer U1B, generates two internal voltages both of which are approximately half the 5 V supply voltage:

- the centre voltage (CV) on pin 13 for the digitising window;
- the reference voltage (VREF) on pin 16.

Control/bus links to/from the sound processor are:

- a data bus and an address bus between the RAM U3 and U4 (pins 27 to 34 for data and pins 35 to 54 for address);
- a communication link from the microprocessor U22 on the main board is via a three wire bus on pins 1. 63 and 64 of U4.

Output from the Sound Processor

There are two output paths for the audio signals:

- an analogue path for the left, right and centre signals;
- a digital path for the surround and right and left simulated component signals.

The analogue signals are buffered by the operational amplifiers U1D (for right), U1C (for left) and U1A (for centre) and associated components. The outputs of these operational amplifiers should have a DC component equal to the reference voltage VREF (see also Oscillogram 15). The signals then have this DC component removed by C31, C51, C54.

The left and right signals are then fed to the summing amplifiers U5B and U5D respectively. The centre channel goes through a bass splitting filter which is a simple cross-over filter of frequency 100 Hz comprising U5A, U5C and associated components. This filter removes the centre channel's bass frequency which is then added to the left and right channels 3dB lower in level at the summing amplifiers U5B and U5D. The hardware allows this bass splitting filter to be turned off by means of switches U10C, U10D and associated components. There is, however, no software facility to do this at present, so U10D is always closed and U10C is always open. The centre channel is routed to pin 19 of the volume control IC U9 via the coupling capacitor C109.

After the digitally processed signals have undergone D/A conversion in U4, they emerge at pins 11 (right simulated), 6 (left simulated) and 12 (surround) and are buffered by the hold capacitors C37, C38, C39 and the op amps U7A, U7C, U7B respectively. The signals are then low pass filtered and buffered as follows:

- filter C35, C36 and associated resistors then buffer Q1 for right simulated;
- filter C24, C25 and associated resistors then buffer Q2 for left simulated;
- filter C21, C22 and associated resistors then buffer U7D for surround.

The surround signal passes directly into the volume control IC U9 at pin 2. The right and left simulated signals are switched via U10B and U10A respectively to the summing amplifiers U5D and U5B which add the following signals together to create the combined left and right channels:

- the left and right signals from the sound processor;
- the bass from the centre channel;
- the right and left simulated components.

The combined left and right channels then pass to the volume control IC U6 (pins 19, 2) via C96 and C33 respectively.

Noise Sequencer

The sound processor U4 has an integral noise sequencer which tests the operation of the Dolby Pro Logic decoder and also allows you to set the speaker volume levels. The microprocessor U22 on the main board commands the sound processor (via the I^2C serial data bus) to generate the noise sequence.

The noise signals are generated using the digital outputs normally used for the right and left simulated components (i.e. pins 11 and 6 respectively of U4). They are then routed back into the processor via the switches U2A and U2B. In noise sequencer mode, the switch command line goes low to close the feedback path enabling the noise to enter the sound processor. The command line (NOISE_SEL) for the switches U2A and U2B comes from pin 5 of the audio processor U18 (main board). This command line also opens switches U10A and U10B, which prevents the noise signals being added to the left and right channels. The noise signal is then routed to each of the channels under the control of microprocessor U22 which alters the amplitude and phase of the signals coming out of pins 6 and 11 (the left and right digital outputs respectively).

Master Volume, Speaker Level and Treble/Bass Control

U6 and U9 perform the master volume control, the speaker level adjustment and the treble/bass control. U6 and U9 have similar functions and their pins are identically annotated in the circuit diagram - the only differences are:

- U6 is used for left and right channels and U9 is used for centre and surround;
- although U6 and U9 have a common data line (DATA - from pin 37 of microprocessor U22), they have separate clock signals (SCL1SOUND from pin 20 of U22 for U6 and SCL2SOUND from pin 19 of U22 for U9).

The power supply to U6 and U9 is 8 volts; they generate a reference voltage internally at approximately half this voltage which appears at pin 20.

The inputs to the ICs are pins 2 and 19 and these pins should be at half the supply voltage. (See also Oscillogram 16). C17, C95 (on pins 1, 20 of U6) and C97, C106 (on pins 1, 20 of U9) are filter capacitors.

The bass and treble adjustments are made at the Sound Shape Menu and are achieved using the following external capacitors:

- C30, C91 (on pins 4, 17 of U6) and C98, C102 (on pins 4, 17 of U9) for bass control;
- C89, C94 (on pins 6, 15 of U6) and C101, C105 (on pins 6, 15 of U9) for treble control.

All adjustments of the master volume, bass and treble are commanded by the microprocessor U22 on the main board via the two audio I^2C communication links on pins 11, 12 of U6 and U9.

The audio signals are then coupled via separate outputs from U6 and U9 to the power amplifiers (U11A, U11B, U12A, U12B) and to the phono outputs (which are on the main board and are reached via a ribbon cable between PL1 on the main board and PL1 on the sound board). Because of the high gain of the power amplifiers, the signals on pins 8 and 13 of U6 and U9 (see also Oscillogram 17) are very much lower than the signals on pins 7 and 14.

C93, C86 (for U11) and C104, C100 (for U12) couple the signals to the power amplifiers. C103 (on the sound board) and C220, C211, C222, C223, C224 (on the main board) couple the signals to the phono outputs. The ribbon cable between PL1 on the main board and PL1 on the sound board provides the path to the phono outputs (which are on the main board).

Power Amplifiers

The power amplifiers U11 and U12 have a gain of approximately 40 dB and have similar functions - the only difference is that U11 is used for the left and right channels and U12 is used for the centre and surround channels. They are mounted on a heatsink and have a power supply of approximately 33 V at pin 12. They generate a reference voltage internally at approximately half this voltage which appears at pin 4. The outputs of these power amplifiers (pins 11, 13) should have a DC component equal to this reference voltage (see also Oscillogram 18).

The components around U11 and U12 have the following functions:

- C66 (for U11) and C77 (for U12) on pin 4 filter the reference voltage;
- C67, C68 (for U11) and C78, C79 (for U12) on pins 2 and 7 filter the feedback signal;
- C71, R79, C69, R78 (for U11) and C82, R85, C80, R84 (for U12) on the outputs (pins 11 and 13) prevent oscillations;
- C72, C70 (for U11) and C83, C81 (for U12) on pins 11 and 13 are decoupling capacitors to the speakers;
- C73, C74 (for U11) and C84, C85 (for U12) on pin 12 are power supply filter capacitors.

Power amplifier U12 can amplify either the centre or the surround signal depending on the status of the switch U2C. This status depends on the speaker configuration set at the Speaker Configuration Menu (i.e. centre for Configuration 3 and surround for Configurations 1 and 2). It is controlled by pin 24 (the SPEAKER_SEL line) of the microprocessor U22 on the main board. D9, R83 and C124 ensure smooth switching when the power is removed.

Speaker Mute and Anti Pop Circuit

Q3 and Q4 form a SCHMITT trigger circuit which monitors the 5 V D.C. power supply and activates when the mains power supply is turned off. Zener diodes D1 and D2 set the reference for the SCHMITT trigger. When the trigger activates. Q6 conducts which mutes the amplifiers to prevent a "pop" sound being heard. The line PWR-MUTE has to be high (i.e. at least 30 V) for the amplifiers to mute. In addition to this, transistors Q7, Q8, Q9, Q10 prevent the coupling capacitors (C86, C93, C100, C104) to the power amplifiers from discharging and creating a "pop" sound. R82 and Q11 reset the sound processor U4 during a power down, as mentioned earlier in the section entitled "Sound Processor - Peripheral Components and Control Lines".

OSCILLOGRAMS FOR FAULT TRACING

The oscillograms which follow are divided into 5 main sections: Video, Audio, SMPS, Control and VideoCrypt (including some tests that can be performed on the card reader PCB). It is important that, within each of these sections, you check the presence of the signals in the order they are given (e.g. for the video circuitry test at points 1 to 11 in that order).

The oscillograms are numbered sequentially and the appropriate section and PCB is given above each. The oscillogram numbers are marked on the circuit diagrams and the PCB component ident diagrams. The oscillogram test points have been chosen to be on the more convenient side of each board (e.g. non-copper side of the main PCB, copper side of the sound PCB etc.). If possible, the other points where we suggest you make checks are also on these sides of the PCBs.

Alongside each oscillogram is a note of where the test point is, a brief description (including any special instructions) and notes on which components you need to check if your oscillogram is not like that shown.

NOTE: The horizontal and vertical scales of each oscillogram is shown at its right hand side; the 0 V point is shown at its left hand side. When the oscilloscope is DC coupled, 0 V appears at the bottom of the oscillogram; if it needs to be AC coupled this fact is mentioned in the text and 0 V is near the centre of the oscillogram.

Generally, if you suspect that an IC is not functioning, before you try to replace it you should check the following:

- that it is receiving its supply at the appropriate pin (if it is not being supplied, trace back the supply line to the PSU to find where there is a fault);
- that the IC is receiving instructions from the microprocessor U22 or port expander U25 via the control lines at the appropriate pins;
- that the receiver has been configured correctly at the appropriate menus (see pages 7 to 13 and also the User Manual for details).

As stated at the top of page 43, there are several ICs within the VideoCrypt circuitry that you are not allowed to replace. If you suspect faults within the VideoCrypt circuitry, you must return the receiver to the Pace service centre.

Test Point 1: LK 182 (Main PCB)

Description: AC coupled oscilloscope

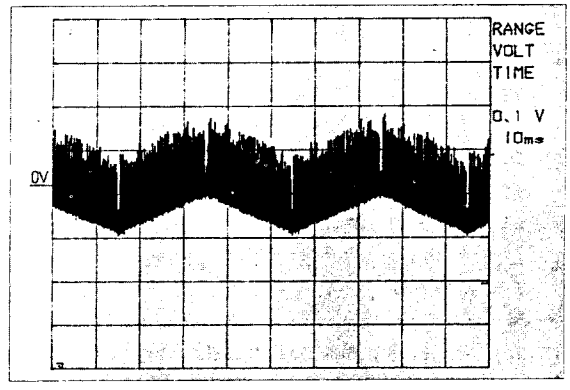
The trace shows tuner output (i.e. totally unfiltered video).

The signal may look noisier than the trace shown if the signal is weak or the dish antenna is small.

If the trace is not as shown, check:

- that the tuning voltage at TP77 changes when different programmes are selected;
- the prescaler output on pin 18 of TUNER1 (i.e. at LK207);
- the 4 MHz reference at pin 12 of U26;
- the LNB voltage on pin 5 or pin 3 of TUNER1 (depending on whether the current programme is from LNB 1 or LNB 2 respectively).

1. VIDEO MAIN PCB



Test Point 2: positive side of C501 (Main PCB)

Description: AC coupled oscilloscope

Traces 2A and 2B show the normal video signal at test point 2, only the time axis is different; there may be slight variations in the trace, depending on picture content.

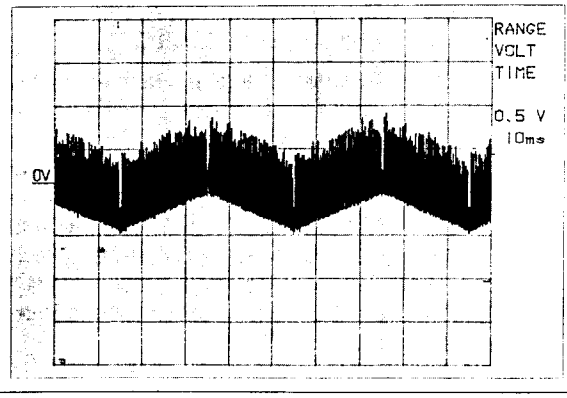
If the trace is not as shown, check:

- the route through U26, i.e. check back from pin 20 through to pin 3 of U26 to check that the trace is as shown. (Consult the circuit description for U26.)

Note that pin 3 of U26 is similar, in effect, to point 1 above.

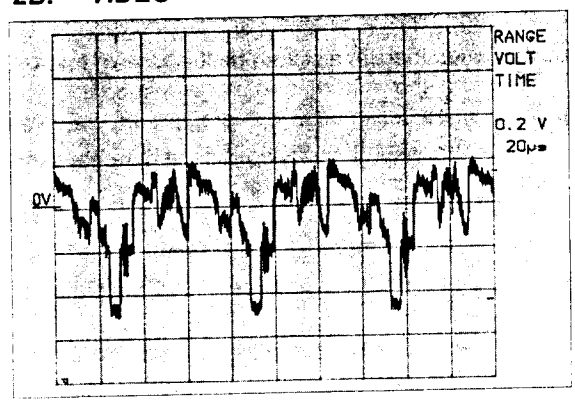
Note that pin 6 of U26 is similar, in effect, to point 1 above, but should give a trace of much larger amplitude (approx. 3 V p-p).

2A. VIDEO MAIN PCB



Test Point 2: positive side of C501 (Main PCB) (see previous Oscillogram 2A)

2B. VIDEO MAIN PCB



3. VIDEO MAIN PCB

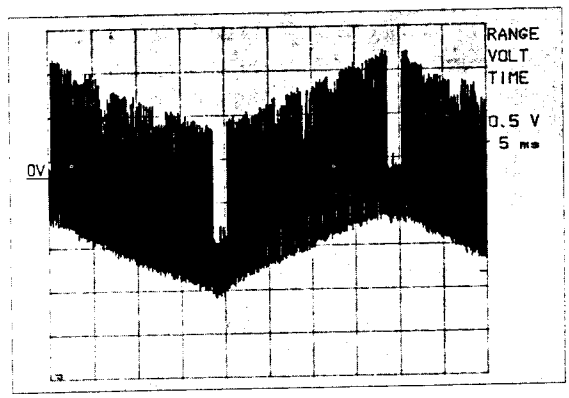
Test Point 3: Junction of L18 and R336 (Main PCB)

Description: AC coupled oscilloscope

The trace shows unclamped video of the correct gain. This is the video signal at one side of Q59 and C194, whereas Oscillogram 4, below, shows the signal at the other side.

If the trace is not as shown, check:

- Q53 and associated components;
- the gain stage (Q57, Q58).



4. VIDEO MAIN PCB

Test Point 4: Junction of L19 and R345 (Main PCB)

Description: AC coupled oscilloscope

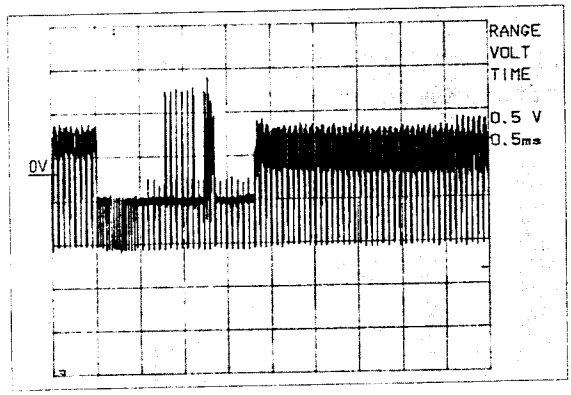
The trace shows clamped video at the correct DC level of 2.6 V (black level). This is the video signal at the opposite side of Q59 and C194 (compared with Oscillogram 3).

If the trace is not at the correct DC level, check:

- that the DC level at the base of Q99 (i.e. at the positive side of C198) is correct (2.6 V) - if it is, then Q99 and/or Q100 may be faulty; if it is not correct then there may be a problem in the VideoCrypt circuitry.

If the trace is not as shown, but looks like Oscillogram 3:

- Q59, Q99 and/or Q100 may be faulty.



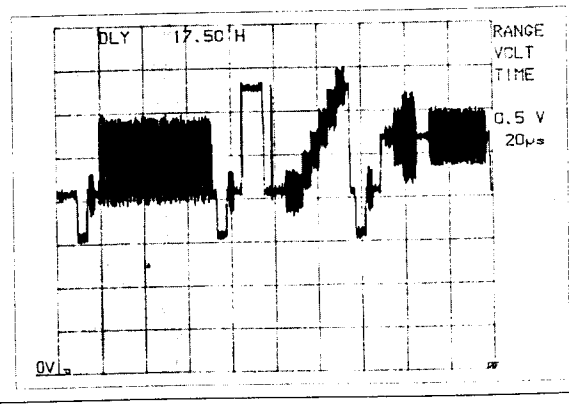
5. VIDEO MAIN PCB

Test Point 5: LK151 (Main PCB)

Description: This trace also shows clamped video; its DC level is important - it should be approx. 2 V black level and approx. 1.85 V peak-peak (sync. to bar).

If the DC level is not correct, check:

- Q62, Q98, Q99 Q100 and their associated circuitry.



Test Point 6: Pin 12 of U7 (Main PCB)

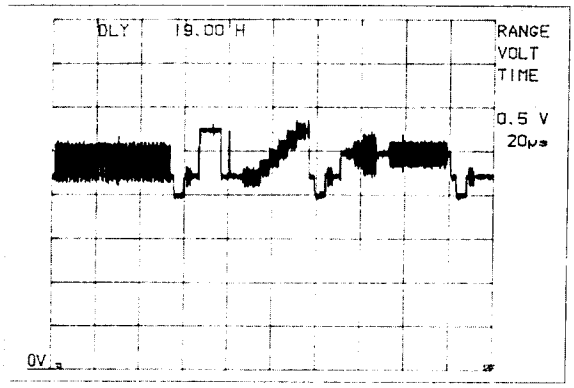
Description: Trace 6A shows the trace you would expect at test point 6 when there is a picture on the screen; trace 6B (next oscillogram) shows what to expect at test point 6 if there is a plain coloured background with graphics on the screen.

Check for trace 6A. If this is as expected, remove the input and select a plain coloured screen with graphics (e.g. Main Menu) and look for trace 6B.

If the traces are not as shown, check:

- that the horizontal sync is being fed into pin 30 of U7 (see oscillogram 7);
- that the vertical sync is being fed into pin 31 of U7 (see oscillogram 8).

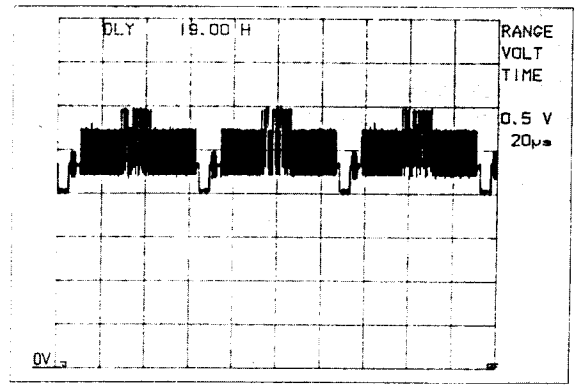
6A. VIDEO MAIN PCB



6B. VIDEO MAIN PCB

Test Point 6: Pin 12 of U7 (Main PCB) (see oscillogram 6A)

Description: Trace 6B shows what to expect at test point 6 if there is a plain coloured background with graphics on the screen. The graphics can be seen on the centre of the trace and, similarly, on the traces at either side of centre.



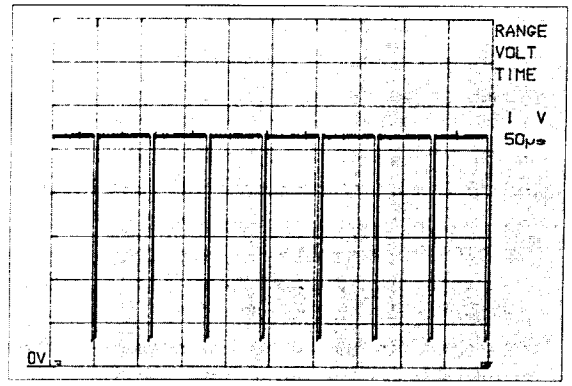
7. VIDEO MAIN PCB

Test Point 7: Pin 30 of U7 (Main PCB)

Description: The trace shows the horizontal sync..

If the trace is not as shown, check:

- U29, Q65 and associated components in the sync. separator circuitry



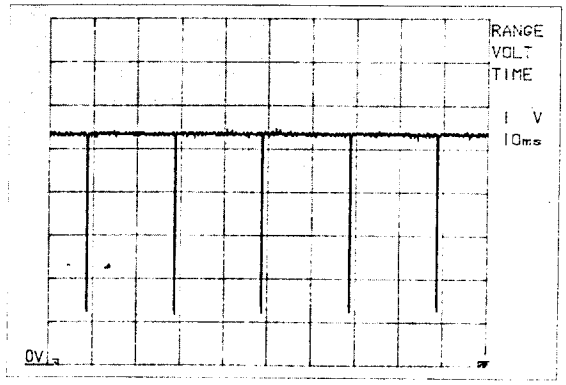
8. VIDEO MAIN PCB

Test Point 8: Pin 31 of U7 (Main PCB)

Description: The trace shows the vertical sync..

If the trace is not as shown, check:

- U29 and associated components in the sync. separator circuitry



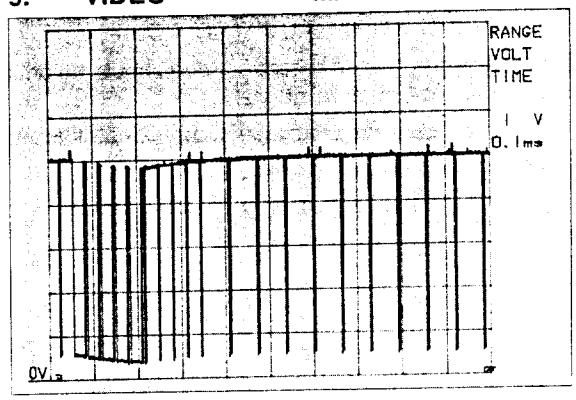
Test Point 9: LK69 which is the same as pin 27 of U7 (Main PCB)

Description: The trace shows the composite sync..

If the trace is not as shown, check:

- U7, X4 and associated circuitry

9. VIDEO MAIN PCB



Test Point 10: LK270 which is the same as pin 19 of SK2 (TV SCART) (Main PCB)

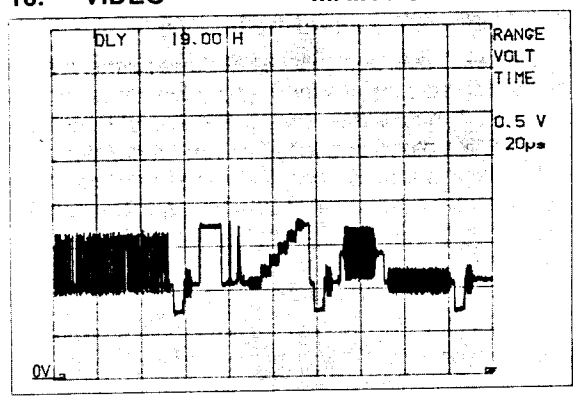
Description: The trace shows approx. 1 V peak-to-peak of clamped composite video (if the TV is connected to the SCART socket).

If the trace is not as shown or has the wrong amplitude, check:

- Q41, Q40 and associated circuitry.

Note that the video output to the TV SCART at test point 10 depends on the routing through switch U21 to pin 3 of U21. For the satellite video signal pin 4 should be connected to pin 3 (see the video circuit description on page 22).

10. VIDEO MAIN PCB



Test Point 11: Pin 40 of SK3 (AV1 AUX SCART) (Main PCB)

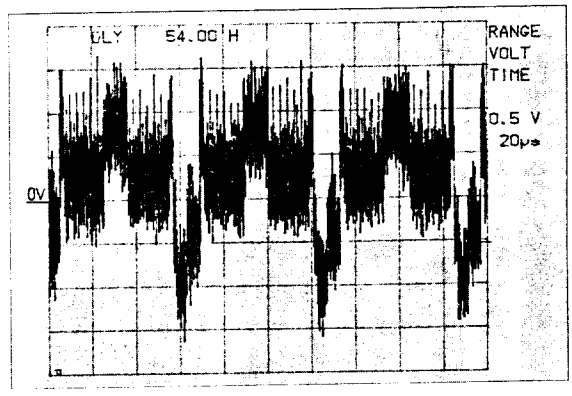
Description: AC coupled oscilloscope

The trace 11A is when PAL has been set at the "Decoder Output" option in the External AV Menu. It shows baseband video and should be approx. 2 V peak-to-peak. See also Oscillogram 11B below.

If the trace is not as shown or has the wrong amplitude, check:

- U26 and the route from pin 22 of U26 (Q54, Q55 and associated circuitry).

11 A. VIDEO MAIN PCB



Test Point 11: pin 40 of SK3 (AV1 AUX SCART) (Main PCB)

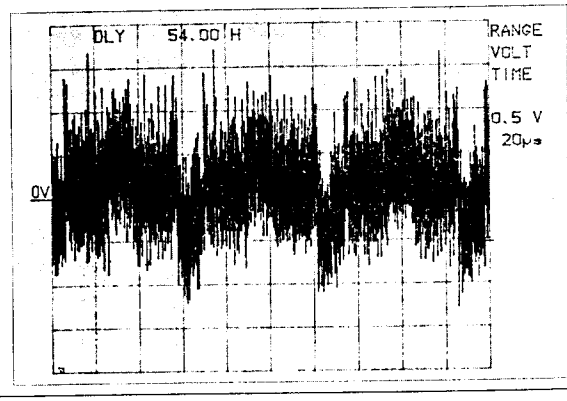
Description: AC coupled oscilloscope

The trace 11B is when MAC has been set at the "Decoder Output" option in the External AV Menu. It shows baseband video and should be approx. 1 V peak-to-peak. See also Oscillogram 11A above.

If the trace is not as shown or has the wrong amplitude, check:

- U26 and the route from pin 22 of U26 (Q54, Q55 and associated circuitry).

11 B. VIDEO MAIN PCB



Test Point 12: Pin 63 of U18 (Main PCB)

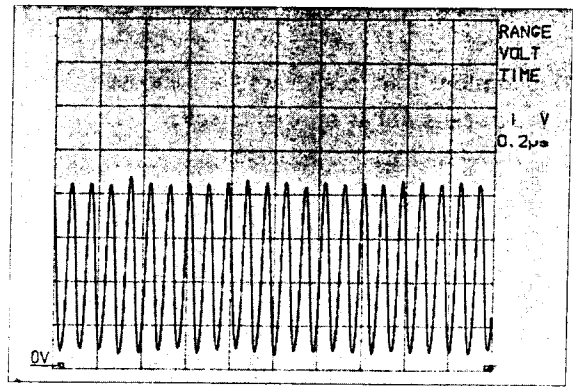
Description: The oscilloscope probe should be on x 10, otherwise it will load the crystal.

The trace shows the amplitude of the 18.432 MHz reference.

If the trace is not as shown, check:

- X2 and associated circuitry.

12. AUDIO MAIN PCB



Test Points 13: Pins 1, 7 and 14 of U19 (Main PCB)

Description: AC coupled oscilloscope

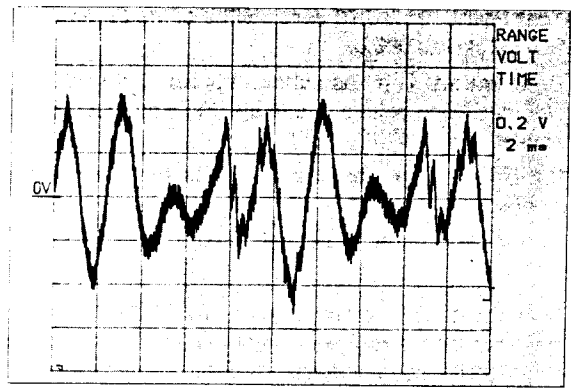
The trace should be similar at all three points. It shows the amplified audio signals for the right total channel (pin 7) and left total (pin 1) before they pass to the Sound PCB. At pin 14 the signal is the mono output to the UHF modulator (i.e. the left and right total channels combined and pre-emphasised by U19C) - but note that if the receiver is in Speaker Configuration 2, pin 14 is the centre channel from the Sound PCB, so in that case you need to ensure that your audio source programme has a centre channel (see also the notes at Test point 15 below).

The signal should be biased around 0 V, so ensure that the trace is produced with 0 V at the centre of the screen.

If the trace is not as shown, check:

- the components and circuitry back to and including U18.

13. AUDIO MAIN PCB



Test Point 14: Pin 56 of U4 (Sound PCB)

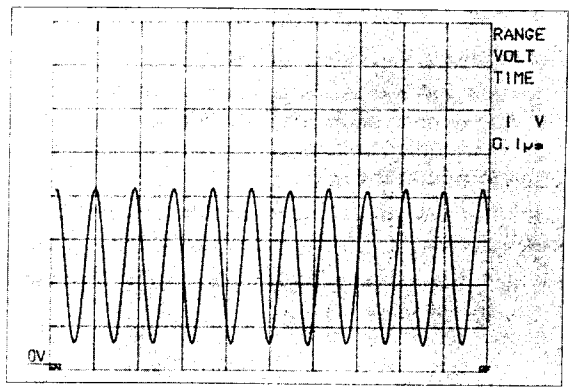
Description: The oscilloscope probe should be on x 10, otherwise it will load the crystal.

The trace shows the amplitude of the 11.2896 MHz reference.

If the trace is not as shown, check:

- X1 and associated circuitry.

14. AUDIO SOUND PCB



Test Points 15: pins 8, 9, 17, 18 of U4 (Sound PCB) for inputs pins 6, 11, 12, 19, 20, 21, 22, 23, 24 of U4 for outputs

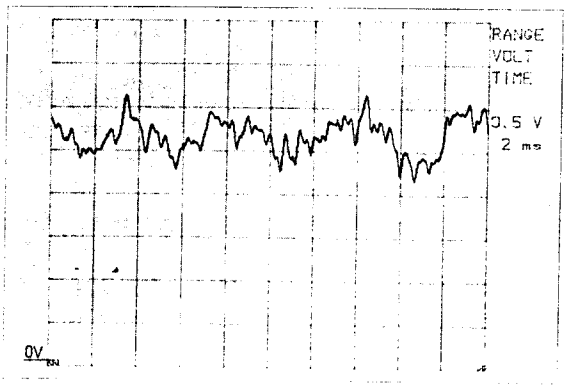
Description: The trace should look similar at all points, as the different points are the different audio channels. To be able to see traces at all points, the programme you use as an audio source must have all the audio channels (L, R, C and S) which will not be the case for old films (made without Dolby Stereo). For most of the test points, it is best to set the receiver to a music programme with "Simulated" sound mode and "None" effect; for pins 6 and 11 it is best to use the "Cosmos" effect.

Check that the audio signal is centred at approx. 2.5 V DC.

If it is not, check:

- U1B (pin 6 or 7) as this IC buffers the 2.5 V reference from pin 13 of U4 to pin 16 of U4.

15. AUDIO SOUND PCB



Test Points 16: pins 2 and 19 of U6 and U9 (Sound PCB) for inputs; pins 7 and 14 of U6 and U9 for outputs to phono sockets

Description: AC coupled oscilloscope

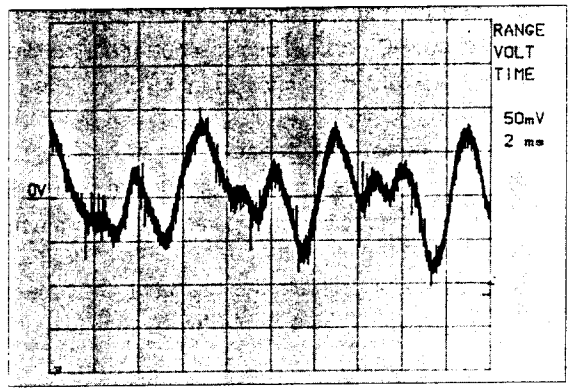
The trace should look similar at all points, as the different points are associated with the different audio channels (but note that the amplitude of the output signal depends on the volume setting for the appropriate channel). To be able to see traces at all points, the programme you are using as an audio source must have all the audio channels (L, R, C and S) which will not be the case for old films (made before the advent of Dolby Stereo). It is best to set the receiver to a music programme with "Simulated" sound mode and "None" effect.

Check that the audio signal is centred at approx. 4 V DC.

If it is not, check:

- U6 and U9 as they generate the 4 V reference at pin 20.

16. AUDIO SOUND PCB



Test Points 17: pins 8 and 13 of U6 and U9 (Sound PCB) for outputs to power amplifiers

Description: AC coupled oscilloscope

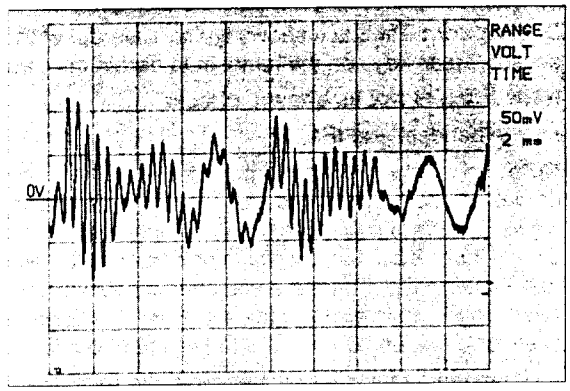
The trace should look similar at all points, and similar to that shown in trace 16 above, except that the amplitude of the signal will be much smaller (once again the amplitude also depends on the volume setting for the appropriate channel). The notes given in the description above also apply.

Check that the audio signal is centred at approx. 4 V DC.

If it is not, check:

- U6 and U9 as they generate the 4 V reference at pin 20.

17. AUDIO SOUND PCB



Test Points 18: pins 11 and 13 of U11 and U12 (Sound PCB) i.e. outputs from these power amplifiers

Description: AC coupled oscilloscope

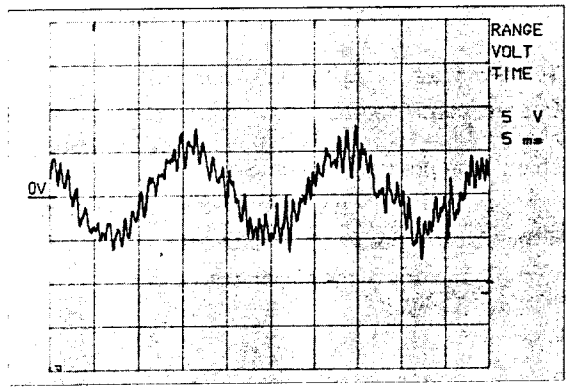
The trace should look similar at all points, and have an amplitude much greater than that in Oscillogram 17 above. The notes given in the description of Oscillogram 16 above also apply in this case.

Check that the audio signal is centred at approx. 16 V DC.

If it is not, check:

- U11 and U12 as they generate the 16 V reference at pin 14.

18. AUDIO SOUND PCB



WARNING: While you are making the following measurement, you and the oscilloscope must NOT be earthed. Do not touch any metal parts of the oscilloscope.

Test Point 19: End of R8 (i.e. same as U1, pin 6) (Main PCB)

Description: The frequency of the trace will vary with the input voltage and the PSU load.

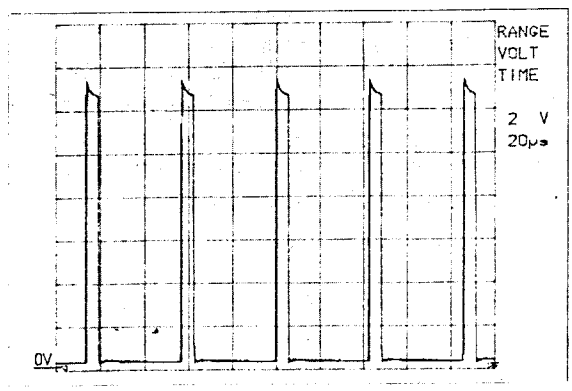
If trace is not as shown, TURN OFF THE PSU and check:

- the SMPS circuit; if fuse FS1 keeps blowing, check for shorts on any of the supply rails and that Q1 is not short-circuit; check the continuity of the loop from D12 to R13.

Taking heed of the WARNING above, power up the receiver again and check that:

- the voltage at positive side of C6 (i.e. same as pin 7 of U1) charges up to 16 V then drops to approx. 13 V - if it does not, check FS1 or suspect U1;
- that the reference voltage at LK2 (i.e. junction of R12, R13) is 2.4 V - if it is not, then D9 or U2 is probably faulty.

19. SMPS MAIN PCB



Test Point 20: Pin 1 of display (VFD1) (Display PCB)

Description: AC coupled oscilloscope (note position of 0 V)

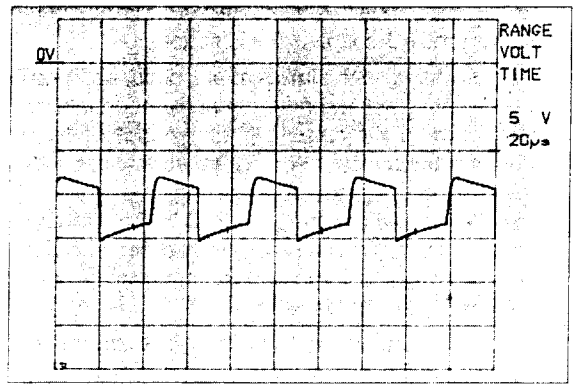
The presence of a trace shows that the vacuum fluorescent display can operate.

If the trace is not detected, check:

- Q6 and associated components on the display PCB;
- Q12, Q13 and associated components on the main PCB which form the oscillator for the 22 kHz signal.

Note: if there is a fault with this oscillator, the tone-switching facility on the LNB supply may also be faulty.

20. CONTROL DISPLAY PCB



Test Point 21: Pin 2 of IR1 (Display PCB)

Description: The trace shows typical data out of the IR sensor; press keys on the handset to obtain the trace.

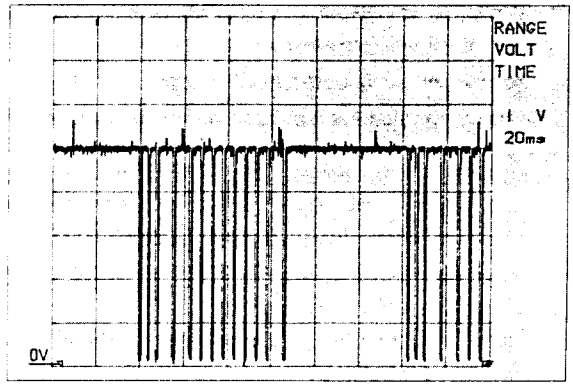
If the trace is not as shown, check:

- the handset and IR1.

Note: when you operate the handset keys, front panel buttons or dial, you could get a situation where the front panel display works (as this is controlled from microprocessor U1 on the display board) but this control information is not being passed to the main PCB. Therefore you should check that there are data, clock and interrupt signals at pins 12, 11 and 4 respectively of U1 when you operate the keys/buttons/dial.

If U1 appears faulty, firstly check that the reset line on pin 63 is at least 4 V and that X1 is oscillating at 4 MHz, as both of these are needed for U1 to operate correctly.

21. CONTROL DISPLAY PCB



Test Point 22: Pin 37 of U22 (Main PCB)

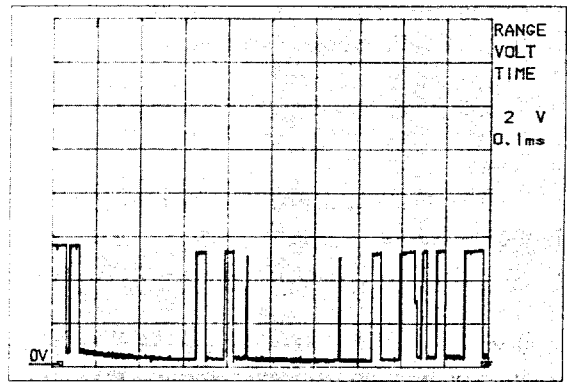
Description: The trace shows a typical serial data (DATA) signal on the I²C bus when the handset keys are pressed to change the programme number.

Press the number keys while looking for the trace.

If the trace is not as shown, check:

- U22 and any of the ICs on the I²C bus.

22. CONTROL MAIN PCB



Test Point 23: Pin 10 of U22 (Main PCB)

Description: The trace shows a typical serial clock (SCL) signal on the I²C bus when the handset keys are pressed to change the programme number. The COMMON_CLK line on pin 29 of U22 should be similar.

Press the number keys while looking for the trace.

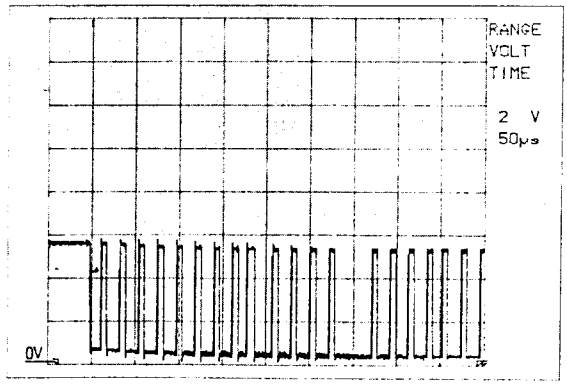
If the trace is not as shown, check:

- U22 and any of the ICs on the I²C bus.

Note: There are also three clocks associated with the Sound PCB which will give similar traces as follows:

- SCL1SOUND on pin 20 when volume of L or R is changed;
- SCL2SOUND on pin 19 when volume of L or R is changed;
- SURROUNDCLK on pin 36 when sound mode or effect is changed.

23. CONTROL MAIN PCB



NOTE: In VideoCrypt fault tracing, you are not permitted to swap out ICs U3 (on the card reader board), U5, U6, U8, U9 and U29, so if you suspect a fault in these ICs you must return the receiver to the Pace service centre.

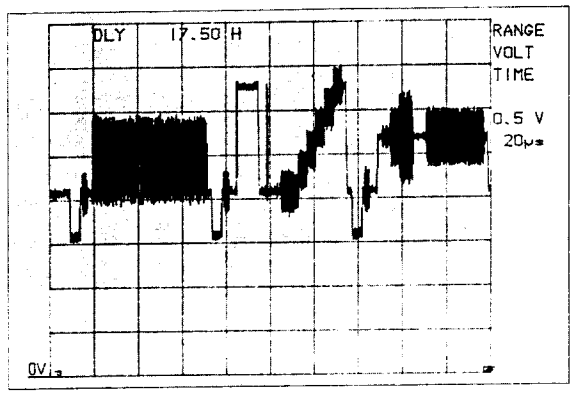
24. VIDEOCRYPT MAIN PCB

Test Point 24: Pin 14 of U5 (Main PCB, VideoCrypt circuit diagram)

Description: This trace shows the clamped video input to the VideoCrypt circuitry (it is the same as Oscillogram 5); its DC level is important - it should be approx. 2 V black level and approx. 1.85 V peak-peak (sync. to bar).

If the DC level is not as shown, check:

- Q62, Q98, Q99 Q100 and their associated circuitry.



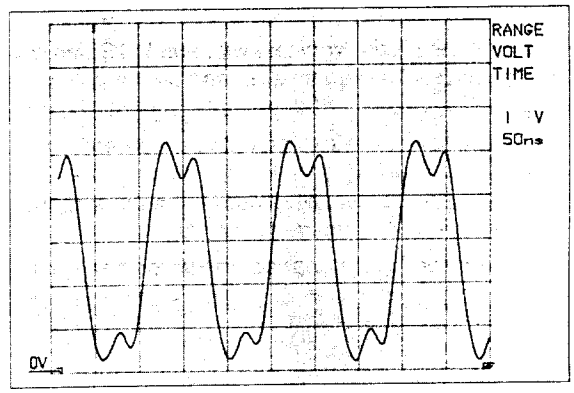
25. VIDEOCRYPT MAIN PCB

Test Point 25: Pin 36 of U5 (Main PCB, VideoCrypt circuit diagram)

Description: The trace shows the 7 MHz clock signal.

If the trace is not as shown, check:

- that X1 is oscillating at 28 MHz.



26. VIDEOCRYPT MAIN PCB

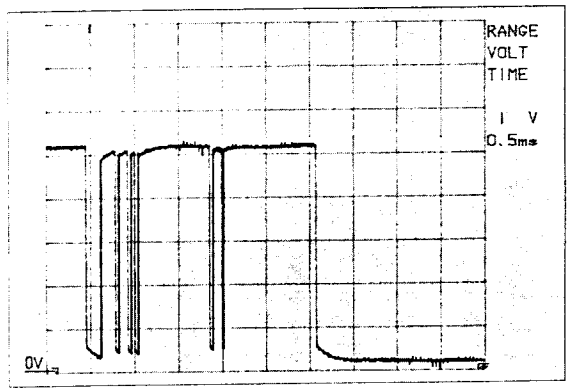
Test Points 26: Pins 23, 24, 25, 26, 27, 28, 29, 30 of U5 (Main PCB, VideoCrypt circuit diagram)

Description: The trace should look similar at all of the above test points, which are the data bus outputs of U5.

Check that all 8 bits of data are present (one bit is associated with each of the above pins). Check that the data has a similar appearance by testing at pins 14 to 21 respectively of U6, at pins 7 to 14 respectively of U8 and at pin 1 to 8 respectively of U9.

If the trace is not as shown, check:

- the appropriate IC and look for shorts or broken tracks on the data bus.



27. VIDEOCRYPT MAIN PCB

Test Point 27: Pin 19 of U29 (Main PCB, main circuit diagram)

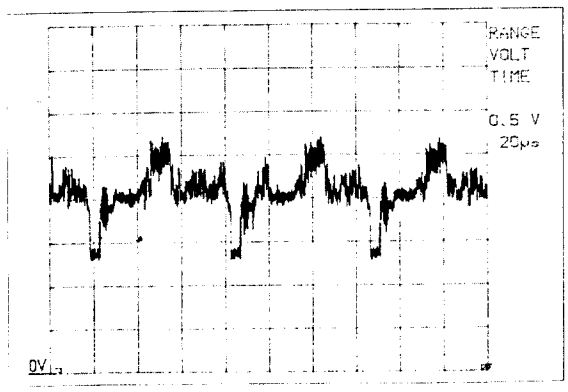
Description: This is the video input to the sync. separator U29. Check the DC level which should be approx. 1.8 V (black level).

If the DC level is not 1.8 V, check:

- that the signal is AC decoupled by C207 (by checking that the voltage is different at LK216).

If the trace is as shown, but there is still a problem, check:

- that the STATION_ID line is high (12 V) at LK74; if it is not then suspect that U29 or associated components are faulty.



Test Point 28: Junction of L28 and X5 (Main PCB, main circuit diagram)

Description: AC coupled oscilloscope

The trace shows the 500 kHz clock signal.

If the trace is not as shown, check:

- L28, R357 and X5

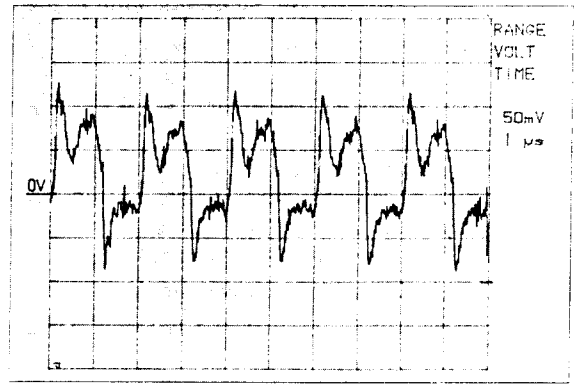
If the trace is as shown, but there is still a problem, check:

- that the reset lines (RST) are greater than 4 V at the following points: U22 pin 6 (main circuit diagram), U5 pin 20 and U8 pin 1 (VideoCrypt circuit diagram)

If any of the above reset lines are less than 4 V, check:

- Q110, Q111, Q114, Q115 and associated components by the connector PL12 pin 3 (main circuit diagram)

28. VIDEOCRYPT MAIN PCB



Test Point 29: LK213 (Main PCB, main circuit diagram)

Description: AC coupled oscilloscope

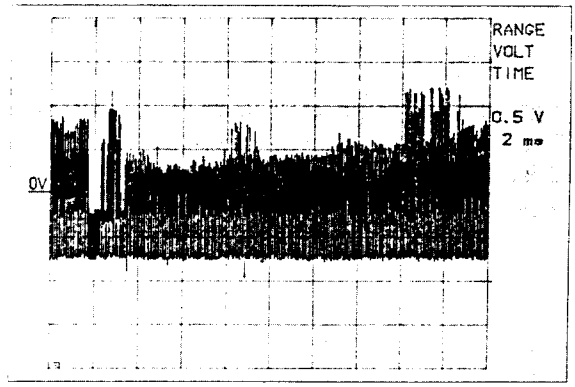
The trace shows the video signal with a scale of 2 ms per division on the time axis. There are three areas of peaks. The first (leftmost) is the vertical sync. and VITS; the other two are the graphics. Oscillogram 29B (see next oscillogram) is a larger scale version of the graphics portion of oscillogram 29A.

The test needs to be carried out when an encrypted programme has been chosen but the viewing card is not inserted (so that graphics messages appear on the screen). Note the voltage level of the inserted graphics.

If the voltage level is not as shown on the trace, check:

- U6, U17 (including R206, R207 and R208), Q101, Q63 and associated circuitry.

29A. VIDEOCRYPT MAIN PCB

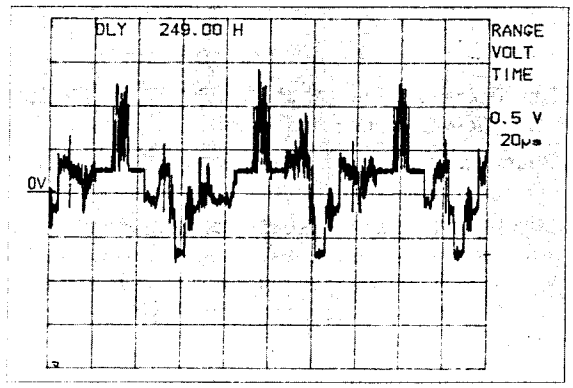


Test Point 29: LK213 (Main PCB, main circuit diagram)

Description: AC coupled oscilloscope

This is a larger scale version of the graphics portion of oscillogram 29A (see preceding oscillogram).

29B. VIDEOCRYPT MAIN PCB



Checks on the Card Reader Board

If the receiver is still showing the "CARD INVALID" message, but testing at the test points 24 to 29 has given traces as shown and you appear to have found no faulty components in the VideoCrypt circuitry, you can then carry out some further checks on the card reader PCB as described below.

Supply to the card reader PCB:

- check that the 30 V, 12 V and 5 V rails are present at PL2 of the card reader PCB (pins 3, 5 and 6 respectively); if they are not present, suspect that the ribbon cable between the main PCB and PL2 is broken; if the 30 V is absent, check Q114 (main PCB) and that the reset line (at pin 4 of PL1) is high.

Supply to the card readers:

NOTE 1: For all the tests below, do the tests for one card reader, then move the card to the other one and test that.

NOTE 2: For the first of the three tests below we recommend that you use a **dummy** card (or a SKY card upside down), because a good, valid card could be damaged if there is a problem with the levels of VCC and VPP (which could go as high as 30 V).

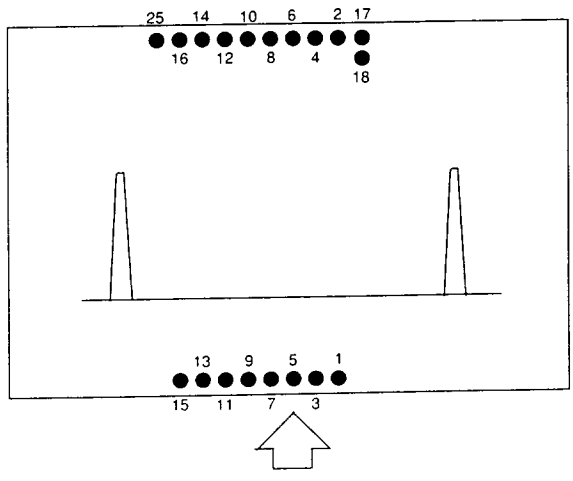
- with the **dummy card** inserted, check that VCC and VPP at pins 9 and 5 respectively of the card reader reach 5 V temporarily as the card is inserted (they do not remain at 5 V unless the card is valid); if they do not reach 5 V, check that VCC and VPP are 5 V at pins 8 and 2 respectively of U3;
- if VCC and VPP are 5 V at U3 but there is still a problem, insert a good card and check Q7, Q8 and associated components (for card reader 1) and Q5, Q6 and associated components (for card reader 2); check also that the card detect line (CD_DET) at pin 17 of U3 goes to 5 V when the card is inserted;
- if there is a difference in the levels of VCC and VPP at the card readers as compared with their levels at U3, check Q2, Q4 and associated components (for card reader 1) and Q1, Q3 and associated components (for card reader 2).

Clock to the card readers:

- check that incoming clock is present at pin 2 of PL1 and the buffered clock output (approx. 3.5 MHz) is present at pin 4 of each card reader (C3CLK line). If there is a problem the clock will be intermittent.

If there is still a problem and the above signals are present, contact the Pace service centre.

Pin Numbering for Card Readers



CARD INSERTED THIS SIDE

GRID REFS - MAIN CIRCUIT (DIAGRAM ON SEPARATE SHEET)

* = not fitted
^ = actually a link (in an inductor position)
A or B = component of different pitch could be fitted
‡ = may be mounted on U22 extension PCB
(NB: C150 as C5, C151 as C6 and X3 as X1)

CAPACITORS

C1	A1
C2	A1
C3	A1
C4	A1
C5	A1
C6	A1
C7	A2
C8	C5
C9	A2
C10	A2
C11	A2
C12	A2
C13	A2
C14	B3
C15	B3
C16	B3
C18	A2
C19	A2
C20	A2
C21	A2
C22	A2
C24	A3
C25	A3
C27	B5
C28	B3
C29	C3
C30	D3
C31	D3
C33	B3
C42	B3
C44	D3
C45	B6
C50	D5
C51	D5
C52	D5
C54	D6
C55	D6
C56	D6
C57	D6
C58	D6
C59	D5
C60	D6
C61	D6
C62	D6
C63	D6
C64	D6
C65	D5
C66	D6
C67*	D5
C68*	D6
C69*	D5
C70	D6
C71	D6
C72	D6
C73	D6
C74	D6
C75	D6
C76	D6
C77	D6
C78	D6
C79	D6
C80	D6
C81	D6
C82	D6
C83	D6
C85	D5
C86	D5
C87	D6
C88	D6
C89	D6
C90	D6
C91	D6
C92	D6
C93	D6
C94	D6
C95	D6
C96	D6
C97	D6
C98	D6
C99*	D6
C100	D6
C101	D5
C102	D5
C103	D5
C104	D5
C105*	C5
C106	D5
C107	C5
C108	A4
C109	A4
C110	B4
C111	A5
C112	A5
C113	A5
C114	A5
C115	A4
C116	A4
C117	A4
C118	A4
C119	A4
C120	A4
C121	A4
C122	A4
C123	A4
C124	B6
C125	B6
C126	B4
C127	B4
C128	B4
C130	B4
C131	A6
C132	A6
C133	A6
C134	A6
C135	A6
C136	A6
C137	B6
C138	B6
C139	B6
C140	B6
C141	B6
C142	B6
C143	C6
C144	C6
C145	C6
C146	C6
C147	B5
C148	B5
C149	B5
C150‡	D4
C151‡	D4
C153	D4
C154	D4
C155*	C5
C157*	C6
C158	D6
C159	C6
C160	C6
C161	C6
C162	C5
C163	A4
C164	C4
C165	C4
C166	C4
C167	C4
C168	C4
C169	C4
C170	C4
C171	C4
C172	C4
C173	C4
C174	C4
C175	C4
C176	C5
C177	C5
C178	C5
C179	B5
C180	C5
C181	C5
C182	C4
C184	C5
C185	C5
C186	C5
C187	C5
C188	C6
C189	B5
C190	B5
C191	B5
C192	B5
C193*	B5
C194	B5
C196	B5
C198	B4
C199	B3
C200	B2
C201	C3
C202	C2
C203	C2
C204	C2
C205	C3
C206	C3
C207	C3
C208	C3
C209	C3
C210	C3
C211	B3
C212	B3
C213	A4
C214	A4
C215	B3
C216	A2
C217	A2
C219	C5
C220	A6
C221	A6
C222	A6
C223	A6
C224	A6
C250	C5
C251	C5
C252	A4
C253	B5
C254	B5
C255	B5
C256	A3
C257	A3
C258	C3
C259	A2
C260	A2
C261	A2
C262	A3
C263	B4
C270	A1
C273	A3
C274	A2
C275	C5
C287	D5
C288	A2
C289	D5
C291	B4
C293	C4
C294	C3
C295	A2
C400*	C6
C401*	B2
C402*	A2
C500	D3
C501	B5
C502	C6
C503	C5
C505	A3
C506	A3
C507	A4
C508	A4
C509	B4
C510	B4
C512	A4
C513*	A4
C514	A4
C515	A4
C516	A4
C517	D5
C518	D6
C519	D3
C580	C6
C581	B3
C582	B5
C583	B5
C584	B5
C585*	B5
C586	B2
C587	D3
C588	B4
C589	B2
C590	A2
C592	B5
C593	A6
C594	C1
C595	B2
C596	C2
C597	C6
C598	C6
C599	C6
C600	D4
C601	A5
C602	A6
C603	C4
C605	B5
C606	A2
C607	C5
C608	B4
C609	B4
C610	B4
C611	B4
C612	B4
C613	C5
C614	A4
C615	A4
C616	C1
C617	D5

DIODES

D1	A1
D2	A1
D3	A1
D4	A1
D5	A1
D6	A2
D8	A2
D9	A2
D10	A2
D11	A2
D12	A2
D12B	A2
D13	B2
D14	A3
D15	A3
D17	A3
D18	B2
D21	A3
D22	A2
D35	D6
D36	D6
D37	D5
D38	A4
D39	A6
D40	B6
D41	B6
D42	C6
D44	C6
D48	B2
D49	C3
D50	C3
D51	C3
D52	C3
D53	C3
D54	A2
D55	A1
D56	A2
D57	C6
D62	A4
D63	C5
D67	D5
D68	B4
D69	B6
D71	A6
D72	A2

INDUCTORS

L1	A2
L3	A2
L6	D6
L7	D6
L8	D5
L9	D5
L10	D6
L11	D6
L12	D6
L13	D6
L15	C4
L16	B5
L17	B5
L18	B5
L19	B4
L20	B3
L21	B3
L22	A4
L23^	B5
L25	A4
L27^	C3
L28	C3
L31	D3
L39	D6
L40	C4
L41	B5
L42	B5
L43	D3
L44	D3
L45^	A3
L46	A2
L47	B4
L48	C4
L49	B3
L50	C5
L51^	C2
L52	B3
L53	A4

LINKS

J1	B4
J2	B4
J3	B4
J4	B4
J5*	C1
LK2	A2
LK3	C2
LK4	C2
LK6*	B3
LK7*	A6
LK8*	A4
LK9*	A4
LK10*	A4
LK11	A1
LK12	B2
LK13	B1
LK14	B1
LK15	B2
LK16	A3
LK17	B1
LK19	C4
LK20	B1
LK21	B2
LK22	B6
LK23	B2
LK24	B1
LK25	A3
LK26	B3
LK27	B1
LK28	B6
LK29	B1
LK30	B1
LK31	C4
LK32	B1
LK33	C5
LK34	D4
LK35	A3
LK36	B1
LK37	B1
LK38	B1
LK39	A3
LK40	C5
LK41	B2
LK43	B1
LK45	A3
LK46	C4
LK47	A4
LK48	C2
LK50	B1
LK51	C3
LK52	B2
LK53	A2
LK54	D5
LK55	C4
LK56	C4
LK57	C4
LK58	C2
LK62	C4
LK63	C4
LK64	B4
LK65	D4
LK66	C6
LK68	B4
LK69	B4
LK70	D1
LK71	D1
LK72	C4
LK73	C4
LK74	C2
LK75	C3
LK76	B2
LK77	B2
LK78	B2
LK80	A2
LK81	C4
LK82	C6
LK83	C3
LK85	C2
LK86	D3
LK87	D1
LK88	D1
LK89	D4
LK90	C2
LK91	A2
LK92	B2
LK93	C2
LK94	A5
LK95	D4
LK96	B1
LK97	D4
LK98	C4
LK99	C4
LK103	D3
LK105	C4
LK106	D4
LK107	C1
LK108	D3
LK109	C3
LK111	D3
LK112	D3
LK113	D3
LK115	D3
LK117	D3
LK118	B2
LK120	B2
LK121	D3
LK122	B2
LK123	C3
LK125	B3
LK127	B2
LK128	D3
LK134	D1
LK136	D1
LK139	B1
LK140	D3
LK141	A3
LK142	C4
LK143	A4
LK145	A3
LK146	A5
LK147	B2
LK148	A5
LK149	B1
LK151	B4
LK152	D3
LK153	B2
LK154	B3
LK155	B3
LK157	B3
LK159	B4
LK160	B2
LK161	A4
LK162	C6
LK163	C6
LK164	A6
LK166	B1
LK168	B1
LK169	C5
LK170	D5
LK171	C6
LK172	C5
LK173	C6
LK174	C5
LK175	C4
LK176	A6
LK177	C5
LK178	A6
LK179	C5
LK180	C6
LK181	C5
LK182	C5
LK183	C5
LK184	B2
LK185	C5
LK186	C5
LK187	C5
LK189	B1
LK190	A6
LK191	A4
LK193	B6
LK195	C5
LK196	D4
LK197	B4
LK198	D4
LK199	C5
LK200	C6
LK201	C5
LK202	C6
LK203	C6
LK204	B2
LK205	B2
LK206	B2
LK207	C6
LK208	C5
LK209	B4
LK210	B2
LK211	B4
LK212	A4
LK213	A5
LK216	C3
LK217	B2
LK218	A5
LK221	B5
LK224	B2
LK225	C4
LK226	A5
LK227	B5
LK228	A5
LK230	B4
LK231	A4
LK232	A3
LK233	B2
LK235	B1
LK236	A3
LK237	A3
LK238	B1
LK239	B5
LK240	A3
LK241	A4
LK242	A5
LK244	B1
LK246	B6
LK247	B5
LK248	B1
LK249	B1
LK250	A6
LK251	A6
LK253	A5
LK256	B6
LK257	B6
LK258	C6
LK259	A6
LK260	A5
LK262	A5
LK263	A6
LK264	B6
LK265	B6
LK266	B2
LK267	C5
LK268	C6
LK269	C5
LK270	A6
LK271	A6
LK272	A5
LK273	B1
LK274	B6
LK275	C5
LK279	B5
LK280	B4
LK281	B4
LK282	C2
LK283	A1
LK284	A4
LK287	B1
LK290	A4
LK291	B4
LK292	C6
LK293	C6
LK294	A5
LK296	C1
LK297	C1
LK298	C1
LK300	C1
LK303	B6
LK304	B5
LK305	B2
LK306	A4
LK307	C1
LK308	C1

GRID REFS - MAIN CIRCUIT DIAGRAM (cont.)

LK309	B5
LK310	D4
LK311	C1
LK312	C1
LK313	D3
LK314	D3
LK315	A2
LK316	A3
LK317	B1
LK318	A4
LK319	A4
LK320	A5

CONNECTORS

PL1	A6
PL2	C1
PL3	C1
PL4	C1
PL5*	A2
PL7	D1
PL10*	B1
PL11*	D5
PL12	D1
PL26*	C4
PL27*	B3
PL30*	B6
PL33*	C5
PL35*	C4
PL38	A2
SK1	A1
SK2	B6
SK3	C6
SK4	A6

TRANSISTORS

Q1	A2
Q2	A2
Q3	A2
Q4	A3
Q5	A3
Q6	A3
Q7	A2
Q9	A3
Q11	A2
Q12	A3
Q13	A3
Q14	B3
Q15	B3
Q16	B3
Q17	D3
Q30	D6
Q31	D6
Q32	C5
Q33	C5
Q35	A6
Q36	B6
Q37	A6
Q38	B6
Q40	B5
Q41	B5
Q42	B6
Q43	C6
Q44	C6
Q45	C6
Q46	C6
Q47	C6
Q48	C6
Q49	C6
Q50	C5
Q51	C5
Q52	C5
Q53	B5
Q54	B4
Q55	B4
Q56	B4
Q57	B5
Q58	B5
Q59	B5
Q61	A3
Q62	B4
Q63	B2
Q64	C3
Q65	C3
Q72	A3
Q73	A3
Q74	D4
Q75	D4
Q76	D4
Q77	C5
Q78	B4
Q98	B4
Q99	B4
Q100	B5
Q101	B3
Q102	C6
Q103	D5
Q104	A4
Q105	B2
Q107	B5
Q108*	A3
Q109	A6
Q110	C2
Q111	C2
Q112	B6
Q113	B6
Q114	C1
Q115	C1
Q116	A4

RESISTORS

R1	A1
R2	A1
R3	A1
R4	A1
R5	A1
R6	A1
R7	A2
R8	A2
R9	A2
R9A	A2
R10	A1
R11	A2
R12	A2
R13	A2
R14	B4
R15	A2
R16	A2
R17	A3
R18	B4
R19	B6
R20	B6
R22	A3
R23	A3
R24	A3
R25	A3
R26	A3
R27	A3
R28	A3
R29	A3
R30	A3
R31	A3
R32	A3
R33	A3
R34	A3
R35	A3
R36	C2
R37	A3
R38	B2
R39	C2
R40	A2
R44	A3
R45	A3
R46	A3
R47	A3
R48	A3
R49	A2
R50	A2
R51	A3
R52	A3
R53	A2
R55	A2
R60	A2
R61	A2
R62	B3
R63	B3
R64	B3
R65	B3
R66	B3
R67	B3
R68	B3
R69	B3
R70	D3
R71	D3
R72	B3
R74	D3
R85	D4
R86	D4
R87	C6
R103	C1
R104	C1
R105	C1
R106	C1
R108	B6
R109	A6
R110	A2
R111	A4
R112	A4
R113	B6
R114	B6
R115	A2
R150	B5
R151	B3
R154*	D1
R155*	D1
R157	D6
R158	D6
R159	D6
R160	D6
R161	D6
R162	D6
R163	D6
R164	D6
R165	D6
R166	D6
R167	D6
R168	D6
R169	D6
R170	D6
R171	D6
R172	D6
R173	D6
R174	D5
R175*	D5
R176	D5
R177	D5
R178	D5
R179	D5
R180	D6
R181	D6
R182	D5
R183	D5
R184	D5
R186	D5
R187	D5
R188	D5
R189	D5
R190	D5
R191	D5
R192	D5
R194	D5
R195	D6
R196	D6
R197	D6
R198	D5
R199	D5
R201	D5
R203	D5
R204	C5
R205	D5
R206	B3
R207	B3
R208	B3
R210	A4
R211	B4
R212	B4
R215	B4
R216	B4
R217	A6
R220	A6
R222	A6
R223	A6
R224	A6
R227	A6
R228	A6
R229	B6
R230	B6
R233	B6
R236	B6
R237	A6
R238	A6
R239	B6
R240	B6
R243	B6
R244	B6
R245	B6
R246	B6
R247	B6
R250	B6
R251	C6
R252	C6
R255	C6
R256	B5
R257	B5
R258	B5
R259	B5
R260	B5
R261	B5
R262	B5
R263	B6
R264	B6
R265	B5
R269	C6
R270	C6
R271	C6
R272	C6
R273	C6
R274	C6
R275	C6
R276	C6
R277	C6
R278	C6
R279	C6
R280	C6
R281	C6
R282	C6
R283	C6
R284	C6
R285	C5
R286	C5
R287	C5
R288	C5
R289	C5
R290	C5
R291	C4
R292	C4
R293	C4
R294	C4
R295	C4
R296	C4
R297	C4
R298	C4
R299	C4
R300	C4
R301	C4
R304	C5
R305	C5
R306	C5
R307	C5
R308	C4
R309	C5
R310	C5
R311	C5
R312	C5
R313	C5
R314	C5
R315	C5
R316	C5
R317	C5
R318	C6
R319	C5
R320	B5
R321	B5
R322	C5
R323	B4
R324	B4
R325	B4
R326	B4
R327	C4
R328	B4
R329	B4
R330	B4
R331	B4
R332	B5
R333	B5
R334	B5
R335	B5
R336	B5
R337	B5
R339	B4
R340	B4
R342	A3
R343	A3
R345	B5
R346	B3
R347	B2
R348	B2
R349	B2
R350	C3
R351	C2
R352	C2
R353	C2
R354	C2
R355	C2
R356	C3
R357	C3
R358	C3
R359	C3
R360	C3
R361	C3
R362	C3
R363	C3
R364	C3
R365	A2
R367	A1
R368	A2
R369	A1
R379	A6
R380	B6
R382	C6
R383	C4
R385	C3
R396	A6
R397	A6
R398	C6
R399	C6
R400	C5
R401	C5
R402	A6
R404	C1
R417	C1
R419	A3
R420	B2
R421	A6
R422	D4
R423*	D4
R424	D4
R425	D4
R426	D4
R427	D4
R428	C5
R429*	A2
R430	C6
R431*	C4
R432	C4
R433	C6
R434	C6
R435	B6
R436	B6
R437	B4
R442	B4
R443	B4
R444	B4
R445	B4
R446	C4
R450*	D1
R506	C1
R512	C4
R515	D4
R518	A6
R520	A2
R521	B6
R523	B4
R534	B3
R535	B2
R539*	B4
R540	B4
R541	B2
R542	B2
R543	A6
R544	A6
R545	B1
R546*	C6
R547*	C5
R548	C5
R554	D5
R555	D5
R556	D5
R559	A3
R560	D4
R561	B1
R562	A6
R563	A6
R567	A6
R568	A6
R569	A6
R572	B1
R574	C5
R575	B5
R576	D6
R577	D6
R578	D6
R579	D6
R580	D6
R581	C6
R590	C1
R592	B4
R594	A2
R594A	A2
R595	C4
R596	B2
R598	D4
R599	D4
R600	A6
R601	D5
R602	D5
R603	D4
R606	C5
R607	C5
R612	C4
R613	C3
R616	D4
R617	D4
R618	A3
R619	D5
R620	A3
R621	C1
R625	B5
R626	B4
R631	B6
R632	B6
R633	D5
R634	A5
R635	B3
R636	D4
R637*	B4
R639	A4
R640	A4
R641	A4
R642	B4
R643	B4
R644	B4
R645	A4
R645A	A4
R646	A4
R647	A4
R648	A4
R649	A4
R650	A4
R651	D5
R652	A4
R653	D4
R655	A2
R656	B6
R657	C1
R658	D4
R659	D4
R660	D5
R661	D5
R662	D5
R663	A3
R665	D4
R666	D5
R667	B5
R668	A4
R671	B4
R673	C4
R674	C4
R675	C4
R676	C3
R677	C5
R680	D4
R681	A2
R682	C5
R684	B6
R700*	D6
R704	B3
R705	B2
R706	B2
R707	B2
R708	B3
R709	C4
R710	A2
R710A	A2
R711	A2
R711A	A2
R712	B4
R713	C3
R714	C5
R715	C5
R716	B5
R720	C3
R721	C3
R722	D4
R723	C4
R724	C4
R725	C4
R727	B1
R728	C5
R729	B4
R730	B5
R731	A3
R732	A3
R733*	A3
R734	A3
R735	A6
R738	A6
R740	C2
R741	C2
R742	C2
R743	C2
R745	A2
R746	C2
R747	C6
R748	B6
R749	B6
R751	C6
R752	C6
R754	D5
R755	A5
R758	B6
R759	A6
R760	A5
R761	B4
R763	C1
R764	D4
R765	B5
R766	B6
R767	D4
R768	D4
R769	D4
R771	C4
R772	C4
R773	C1
R774	C1
R775	A6
R776	A6
R777	B5
R778	A6
R780	C2
R781	A5
R782	A5
R784	A5
R785	A6
R787	D4
R788	C6
R789	B5
R790	D4
R791	D4
R792	B6
R793	B6
R794	B5
R795	B1
R797	D4
R798	D4
R799	B2
R800*	B1
R801*	A6
R802	B6
R803	A1
R804	A1
R805	B2
R806	B2
R807	B2
R809	B4
R810	A4
R811	C1
R812	B5
R813	B3
R818	A4
R819	A4
R820	A4
R821	B5
R822	D5

ICS

U1	A1
U2	A2
U3A	A3
U3B	A3
U7	C4
U15	D6
U16	D6
U17	B3
U18	B5
U19A	A4
U19C	B4
U19D	B4

continued overleaf

GRID REFS - MAIN CIRCUIT DIAGRAM (cont.)

U20	B6
U21	B5
U22*	D4
U25	D4
U26	C5
U27	C5
U29	C3
U30	A4
U31A	C4
U31B	C4
U32	B4

MISC. COMPONENTS

FS1	A1
FS2	A2

HS2	B3
HS3	A3
M20	B5
MOD1-1	D5
MOD1-2	D6
REG1	B3
T1	A1
T3	A2
TST3*	D4
TUNER1	C6
X2	A5
X3‡	D4
X4	C4
X5	C3
X6	A3
X7*	B5

INTERCONNECTIONS

(WITHIN MAIN CIRCUIT DIAGRAM)

AUDIO_MOD	B3, D5
AUXSTAT	B6, D5
AV/AUDIO	B5, B6, D4
BANDWIDTH	C6, D4
CARDSEL1	D1, D4
CBAND	C5, D4
CD_DET	D1, D4
COMMON_CLK	C1, C4, D4
DATA	B5, C1, C1, C4, C5, D4, D4
DEC_STAT	C6, D5
DISH_POS_DATA	C6, D5
FP/MAC_DATA	C1, D5
FP/MAC_INT	C1, D5
FP_CLK	C1, D5
FP_FILAMENT	A3, C1
H/V POLARITY	A3, D4
L_IN	A3, C1
LNB_ON/OFF	A3, D4
LNB_SELECT	C6, D4
LNB_SHORT	A3, C4
MOD_VID_SRC	A4, D4
NOISE_SEL	B5, C1
OF1	B5, C5
OF10	A3, D6
OFF3	B2, C4
R_IN	A3, A6, C1
RST	B4, C1, C1, D4
SCL	A5, C1, C4, C5, D5
SCL1SOUND	C1, D4
SCL2SOUND	C1, D5
SPEAKER_SEL	A4, C1, D5
STATION_ID	B4, C2, D5
STBY	A3, D4
SURROUNDCLK	C1, D5
TONE_ON/OFF	A3, D4
TUNING_VOLTS	B3, C5
TVSTAT	B6, D5
VCRSTAT	A6, D5
VID_OUT	A3, B5

(TO VIDEOCRYPT CIRCUITRY)

BLOCK	B2, C3
CHAR	B2, C3
IVIDEO	B3, C3
OVIDEO	B3, C3
VREF	B4, D3

GRID REFS - SOUND BOARD CIRCUIT (DIAGRAM ON SEPARATE SHEET)

* = not fittted

CAPACITORS

C1	C6
C2	C5
C3	A6
C4	A5
C5	A5
C6	A5
C7	A3
C8	A3
C9	A4
C10	A4
C11	A3
C12	A3
C13	A4
C14	A3
C15	A3
C16	A4
C17	D3
C18	B4
C19	A4
C20	B3
C21	B3
C22	B3
C23	B3
C24	B3
C25	B3
C26	A4
C27	A4
C28	B4
C29	B4
C30	D3
C31	D4
C32*	B2
C33	D3
C34	C3
C35	C3
C36	C3
C37	C4
C38	B4
C39	B4
C40	B4
C41	D5
C42	D5
C43	C5
C44	C5
C45	C5
C46	C5
C47	C4
C48	C4
C49	D4
C50	C4
C51	C5
C52	C4
C53	D4
C54	C4
C55*	A2
C56	C6
C57	B6
C58	C5
C59	D5
C60	D3
C61	C6
C62	B3
C63	A3
C64	A3
C65	C6
C66	C2
C67	C1
C68	C1
C69	C1
C70	C1
C71	C1
C72	C1
C73	C1
C74	C1
C75*	C3
C76	B3
C77	C2
C78	B1
C79	B1
C80	B1
C81	B1
C82	B1
C83	B1
C84	C1
C85	C1
C86	C3
C87	B3
C88	C3
C89	C3
C90	C3
C91	D2
C92*	C2
C93	C2
C94	C2
C95	D2
C96	D2
C97	B3
C98	B3
C99*	B3
C100	B2
C101	B3
C102	B2
C103	B2
C104	B2
C105	B2
C106	B2
C109	C3
C110	B3
C111	C6
C112	C6
C120	B4
C121	A5
C122	D3
C123	B2
C124	B2

DIODES

D1	A1
D2	A1
D3	B4
D4	A4
D5	A4
D6	A4
D7	A4
D8	A5
D9	B2
D10	A3

LINKS

J1	D3
J2	D2
J3*	B2
J4	B3
J5	B2
J6	A2
J7	A2
J8*	A2
J9*	B2
J10	B2
J11*	A2
LK1	A2
LK2	D6
LK3	A6
LK4	C6
LK5	B2
LK6	D6
LK7	B1
LK8	B1
LK9	B3
LK10	B2
LK11	C5
LK12	D5
LK13	D6
LK14	C5
LK15	C4
LK16	C4
LK17	B4
LK18	D5
LK19	D6
LK20	D6
LK21	D5
LK22	D5
LK23	D5
LK24	D5
LK25	A5
LK26	A4
LK27	B4
LK28	B4
LK29	D5
LK30	C3
LK31	D6
LK32	D5
LK33	B4
LK34	B3
LK35	C4
LK36	D6
LK37	D4
LK38	B3
LK39	D5
LK40	D6
LK41	A5
LK42	C4
LK43	C3
LK44	D5
LK45	A2
LK46	B2
LK47	A1
LK49	A3
LK51	C2
LK52	D3
LK53	D5
LK54	B1
LK55	B2
LK56	D3
LK57	C2
LK58	D3
LK59	D6
LK64	D5
LK65	C1
LK66	C2
LK67	C3
LK68	D2
LK70	B3
LK71	B2
LK72	B2
LK73	D5
LK75	D6
LK76	D5
LK77	D6
LK78	D5
LK79	D5
LK80	D5
LK81	B4
LK82	C5
LK83	A3
LK84	D6
LK85	D5
LK86	B1
LK87	C1
LK88	B3
LK89	B
LK90	B2
LK92	C1
LK93	C1
LK95	C6
LK96	C2
LK97	D5
LK98	C2
LK99	C2
LK100	B2
LK101	C2
LK102	B3
LK103	C2
LK104	B2
LK105	C1
LK107	B2
LK108	C1
LK109	C2
LK110	A1
LK111	A1
LK112	B1
LK113	B1
LK114	C1
LK115	B1
LK116	B1
LK117	A1
LK121*	D6

CONNECTORS

PL1-1	B1
PL1-2	C2
PL1-3	C3
PL1-4	B3
PL1-5	B3
PL1-6	B2
PL2	C6
PL3	D6
PL4	C1
PL6-1*	B1
PL6-2*	D2
PL6-3*	D3
PL6-4*	B3
PL6-5*	B3
PL6-6*	B2
PL7*	D6
PL8*	C6
SK1A	C1
SK1B	C1
SK1C	B1
SK1D	B1

TRANSISTORS

Q1	C3
Q2	B3
Q3	A2
Q4	A1
Q5	C4
Q6	A1
Q7	B1
Q8	A1
Q9	A1
Q10	A1
Q11	A5

RESISTORS

R1	D5
R2	A5
R3	A5
R4	A5
R5	A3
R6	A3
R7	A3
R8	A4
R9	A3
R10	A4
R11	A3
R12	A3
R13	A3
R14	A3
R15	A2
R16	B1
R17	B1
R18	A1
R19	B3
R20	B3
R21	B3
R22	B4
R23	B3
R24	B3
R25	B3
R26	B4
R27	C3
R28	C3
R29	C4
R30	C4
R31	D5
R32	C5
R33	C5
R34	C5
R35	C5
R36	C4
R37	B4
R38	C4
R39	C4
R40	C4
R41	C4
R42	D4
R43	D4
R44	D4
R45	C4
R46	C4
R47	D3
R48	C3
R49	C4
R50	A1
R51	C3
R52	A1
R53	D4
R54	C4
R55	A4
R56	A4
R57	A4
R58	A4
R59	C3
R60	B3
R61*	A2
R62*	A2
R63	B4
R64	B4
R65	A4
R66	A4
R73	A2
R78	C1
R79	C1
R82	A5
R83	B2
R84	B1
R85	B1
R89	A2
R105	C4
R106	C4
R107	B1
R108	B1

ICS

U1A	C5
U1B	B4
U1C	C5
U1D	D5
U2A	A3
U2B	B3
U2C	B2
U3	B6
U4	B5
U5A	C4
U5B	C3
U5C	D3
U5D	D3
U6	D3
U7A	C4
U7B	B4
U7C	B4
U7D	B3
U8A	A4
U8B	A4
U8C	A3
U8D	A3
U9	B2
U10A	B3
U10B	C3
U10C	D4
U10D	C4
U11	C1
U12	B1

MISC. COMPONENTS

X1	A5

INTERCONNECTIONS

C86_MUTE	A1, C3
C93_MUTE	A1, C2
C100_MUTE	A1, C2
C104_MUTE	A1, B2
COMMON_CLK	A6, D6
DATA	A6, C2, B2, D6
DPLD_WIDE	C4, C6
L_IN	A2, D6
NOISE_SEL	A6, C6
PWR_MUTE	A1, B2, C2
R_IN	B2, D6
SCL1SOUND	C2, D6
SCL2SOUND	B2, D6
SPEAKER_SEL	A2, B3, D6
SURROUNDCLK	A6, D6

GRID REFS - DISPLAY BOARD CIRCUIT (DIAGRAM ON SEPARATE SHEET)

* = not fitted

CAPACITORS

C1	D3
C2	D6
C3	B3
C4	B3
C5	B3
C6	B3
C7	B2
C8	B2
C10	C1
C11	C1
C12	B2
C14	D6
C15	B3
C16	B3
C17	B3
C18	D3
C19	B3
C20	B1
C21	B1
C22	C1

DIODES

D1	A3
D2	A2
D3	A3
D4	A3
D5	B1

INDUCTORS

L1	B2

LINKS

J1	B3
LK1	B1
LK3	C1
LK4	B1
LK5	C2
LK6	C3
LK8	C3
LK9	C3
LK10	C3
LK11	C3
LK12	C3
LK13	C3
LK14	C3
LK15	C3
LK16	C3
LK17	C3
LK18	A1
LK19	A3
LK20	C3
LK21	B2
LK22	A1
LK23	D4
LK24	C2
LK25	A2
LK26	A1
LK27	D4
LK28	D4
LK29	D4
LK30	D4
LK31	C3
LK32	C1
LK33	C2
LK34	B2
LK35	D4
LK36	D4
LK37	D4
LK38	D4
LK39	D4
LK40	C4
LK41	C4
LK42	C4
LK43	A5
LK44	B5
LK45	D6
LK46	A5
LK47	B2
LK48	A4
LK49	D6
LK50	B5
LK51	B2
LK52	B2
LK53	B2
LK54	B3
LK55	B6
LK56	B2
LK58	B3
LK59	A2
LK60	A2
LK61	B3
LK62	B1
LK63	B2

CONNECTORS

PL1	B1
PL2	C2
PL3	C2

TRANSISTORS

Q1	C5
Q2	B5
Q3	B5
Q4	A5
Q5	D6
Q6	D6
Q7	A5
Q8	B1
Q9	A2
Q10	A2

RESISTORS

R1	D3
R2	D3
R3	C5
R4	C5
R5	B5
R6	B5
R7	B5
R8	B5
R9	B5
R10	A5
R11*	D6
R12*	D6
R13	A5
R14	A5
R15	B2
R16	B2
R17	C6
R18	B6
R19	B6
R20	B6
R21	A6
R22	A2
R23	A2
R24	A3
R25	A3
R26	B1
R27	B1
R29	C2
R30	A2
R31	A2
R32	D3
R33	D3
R34	D3
R36	D6
R37	D6
R38	B1

SWITCHES

SW1	A3
SW2	A3
SW3	A3
SW4	A2
SW5	C1

ICS

U1	B4

MISC. COMPONENTS

IR1	B2
LED1	A2
LED2	A2
LED3*	B1
VFD1	D6
X1	B3

INTERCONNECTIONS

FP_FIL	C2, D6
RST	B3, C1

GRID REFS - CARD READER BOARD CIRCUIT (DIAGRAM ON SEPARATE SHEET)

* = not fitted

CAPACITORS

C1	C5
C2	C5
C3	C5
C4	B5
C5	B6
C6	D5
C7	D5
C8*	B6
C9	B6
C10	C6
C11	D4
C12	D4
C13	A2
C14	A2
C15	D5

DIODES

D1	C5
D2	B5
D3	C5
D4	B4
D5	B6
D6	B5
D7	B6
D8	A5

LINKS

J1*	C3
J2*	C2
J3*	A4

CONNECTORS

PL1	C6
PL2	B6

TRANSISTORS

Q1	C4
Q2	C4
Q3	C4
Q4	C4
Q5	C3
Q6	C3
Q7	C3
Q8	C3

RESISTORS

R1	C5
R2	C5
R3*	B4
R4*	B4
R5*	A4
R6	C4
R7	C4
R8	C3
R9	C3
R10	C3
R11	C3
R12	C3
R13	C3
R14	C3
R15	C3
R16*	A4
R17	D5
R18	D5
R19	C5
R20	D4
R21	C2
R22	A2
R23	C2
R24	C2
R25	C1
R26	C2
R27	B4
R28	A4
R29	B4
R30	B2
R31	A2
R32	A4
R33	B5
R34	C5
R35	C5
R36	C4
R37	C4
R38	C4
R39	C4
R40	B6

ICS

U1	C5
U2	B5
U3	D5
U4A	C6
U4B	C6

MISC. COMPONENTS

CARD1	C1
CARD2	B1

GRID REFS - IDENT DIAGRAMS FOR MAIN PCB

* = not fitted
† = mounted on copper (SMD) side of PCB
^ = actually a link (in an inductor position)
° = actually a capacitor (in a resistor position)
A or B = component of different pitch could be fitted
‡ = may be mounted on U22 extension PCB
(NB: C150 as C5, C151 as C6 and X3 as X1)

CAPACITORS

C1	B2
C2	C2
C3	D2†
C4	D2†
C5	D2
C6	D3
C7	F2
C8	D8†
C9	G2
C10	I4
C11	I3
C12	I3
C13	I4
C14	H5
C15	H5
C16	H5†
C18	I4†
C19	I3†
C20	I3†
C21	F4
C22	I2†
C24	H7†
C25	H6†
C27	D10†
C28	G10†
C29	I11†
C30	G11†
C31	F11†
C32	F11†
C33	G11†
C34	G12†
C35	F13†
C38	G12†
C39	G12†
C40	G12†
C41*	I7†
C42	F10†
C44	I11†
C45	C11†
C50	E4†
C51	E4†
C52	D4†
C54	C5
C55	B5†
C56	B5†
C57	B5†
C58	B5†
C59	B5†
C60	B5†
C61	C5†
C62	C5†
C63	B5†
C64	B5†
C65	C5†
C66	C4†
C67*	C5†
C68*	B5†
C69*	C5†
C70	C4†
C71	C4†
C72	D5†
C73	D5†
C74	D5†
C75	D4†
C76	D5†
C77	D5†
C78	D5†
C79	D4†
C80	C5†
C81	C5†
C82	C5†
C83	C4†
C85	C4†
C86	E4†
C87	D4†
C88	C5†
C89	C5†
C90	C5†
C91	D5
C92	D5†
C93	D5†
C94	C5†
C95	C5†
C96	C5†
C97	D5†
C98	D5†
C99*	D4†
C100	D5†
C101	E4
C102	E5†
C103	E5
C104	E5
C105*	E5†
C106	C6†
C107	C6
C108	E13†
C109	E14†
C110	D13†
C111	D13
C112	D13†
C113	E14†
C114	E14†
C115	D13†
C116	D13†
C117	D14
C118	D13†
C119	D13†
C120	C13†
C121	C13†
C122	D14
C123	C14
C124	D13†
C125	D13†
C126	D12†
C127	D12†
C128	D12
C130	E12†
C131	B7
C132	C9
C133	C9
C134	C9
C135	C9
C136	B6
C137	C9
C138	C9
C139	C11
C140	C11
C141	C9
C142	C10
C143	B12
C144	B12
C145	C12
C146	B11
C147	D12
C148	D13†
C149	D10
C150‡	H6†
C151‡	H6†
C153	G6
C154	F5†
C155*	H6†
C157*	D6†
C158	D6
C159	C6†
C160	D6
C161	D6
C162	D7
C163	F14†
C164	H10†
C165	I9
C166	H10†
C167	H9†
C168	H10
C169	I9
C170	I10†
C171	I10†
C172	I10†
C173	I10
C174	I10†
C175	I9†
C176	D7
C177	E7
C178	D7†
C179	D8†
C180	D7†
C181	E7†
C182	E7†
C184	E7
C185	C7
C186	C7
C187	C7
C188	E6†
C189	D9†
C190	D9†
C191	D8†
C192	D9†
C193*	D9†
C194	D9
C196	E9
C198	E8
C199	F9†
C200	G9
C201	F9
C202	F9†
C203	F9†
C204	F9
C205	G8†
C206	F8†
C207	F9†
C208	G8
C209	G8†
C210	G8†
C211	F10†
C212	F9†
C213	C13†
C214	C13†
C215	F10†
C216	I2
C217	D2†
C219	E8†
C220	B13
C221	B13
C222	B14
C223	B14
C224	B12
C250	D8†
C251	D8†
C252	D14†
C253	E13†
C254	D8†
C255	D8†
C256	I5†
C257	H6†
C258	G9
C259	I4†
C260	I4
C261	I3†
C262	H5
C263	H8†
C270	D2†
C273	I6†
C274	H6†
C275	D8†
C287	G6†
C288	G5
C289	E5
C291	H9†
C293	D11
C294	G8
C295	F2
C400*	F4†
C401*	G9†
C402*	F3
C500	G11†
C501	D9
C502	C7
C503	C8
C505	I7
C506	I7†
C507	D12
C508	E12†
C509	C12
C510	D12†
C512	E11†
C513*	E14†
C514	E14†
C515	D14†
C516	E14†
C517	D4
C518	D4†
C519	G11
C580	D6†
C581	G9
C582	D9†
C583	D8†
C584	D9†
C585*	D8†
C586	G10
C587	I11
C588	I9†
C589	I5
C590	H4
C591	G12
C592	D8†
C593	C7
C594	I14
C595	G10†
C596	G9†
C597	B6
C598	B6
C599	D6†
C600	G6†
C601	D14†
C602	C8†
C603	D7†
C604	G12
C605	E9†
C606	F2
C607	D8†
C608	C10
C609	H14
C610	D12
C611	D12†
C612	D12†
C613	E7†
C614	E14†
C615	E14†
C616	F11†
C617	H7†

DIODES

D1	D3
D2	D3
D3	C3
D4	D3
D5	D2†
D6	E2
D8	F3
D9	G2
D10	H3
D11	H3
D12	H3
D12B	H3
D13	H4
D14	I6†
D15	H5
D17	I5†
D18	I5
D21	I5
D22	I4
D35	B5†
D36	D5†
D37	C4†
D38	D14
D39	E7†
D40	C11†
D41	G6†
D42	G8†
D44	D6
D48	G9†
D49	G8†
D50	G8†
D51	G8†
D52	G8†
D53	G8†
D54	H2
D55	D2†
D56	H3
D57	H8†
D62	J5
D63	I6†
D67	E4
D68	I8†
D69	C11†
D71	C8†
D72	F3

INDUCTORS

L1	G4
L3	G5
L5	G12
L6	B5
L7	B5
L8	B4
L9	C4
L10	D5
L11	D5
L12	C4
L13	C5
L15	I10
L16	D8
L17	D9
L18	D9
L19	E9
L20	F10
L21	F9
L22	D14
L23^	E13
L25	E14
L27^	G9
L28	F8
L31	I11
L35	G12
L36	G12
L39	C6
L40	H10
L41	E7
L42	C8
L43	H10
L44	H10
L45^	E6
L46	F3
L47	I8
L48	I8
L49	E6
L50	E6
L51^	I7
L52	G10
L53	E14

LINKS

J1	C13
J2	D12
J3	D12
J4	C13
J5*	H7
LK2	H3
LK3	I2
LK4	I4
LK6*	F10†
LK7*	B12
LK8*	B12
LK9*	E11†
LK10*	E11†
LK11	D2
LK12	H4
LK13	H5
LK14	F4
LK15	F4
LK16	F4
LK17	F5
LK19	F5
LK20	G5
LK21	G5
LK22	G5
LK23	G5
LK24	H5
LK25	H5
LK26	G5
LK27	G5
LK28	G6
LK29	F6
LK30	F6
LK31	F6
LK32	H6
LK33	H6
LK34	H6
LK35	H6
LK36	H6
LK37	E6
LK38	E7
LK39	H6
LK40	H6
LK41	H6
LK43	I7
LK45	I7
LK46	I7
LK47	I7
LK48	I7
LK50	I7
LK51	I8
LK52	I7
LK53	I7
LK54	H7
LK55	I8
LK56	I8
LK57	I8
LK58	I8
LK60	I8
LK62	H8
LK63	H7
LK64	H8
LK65	H8
LK66	H8
LK68	H8
LK69	H8
LK70	H7
LK71	H7
LK72	H7
LK73	H9
LK74	H9
LK75	H9
LK76	H9
LK77	H9
LK78	H9
LK80	G8
LK81	H7
LK82	G8
LK83	G8
LK84	H8
LK85	G8
LK86	G7
LK87	G7
LK88	G7
LK89	G7
LK90	G8
LK91	G9
LK92	F8
LK93	F8
LK94	G9
LK95	G9
LK96	G10
LK97	I9
LK98	I10
LK99	H10
LK100	I10
LK101	I11
LK103	I11
LK105	I11
LK106	H10
LK107	H10
LK108	H10
LK109	H10
LK110	H11
LK111	H11
LK112	H11
LK113	G11
LK114	H12
LK115	H12
LK116	H12
LK117	G12
LK118	H12
LK119	H12
LK120	I12
LK121	G12
LK122	G12
LK123	F12
LK124	F12
LK125	F12
LK126	F12
LK127	F12
LK128	I13
LK129	I13
LK130	I13
LK131	I13
LK132	I13
LK133	I13
LK134	H13
LK135	H13
LK136	H13
LK137	H13
LK138	H13
LK139	G14
LK140	G13
LK141	G14
LK142	G14
LK143	G14
LK145	F14
LK146	F14
LK147	F14
LK148	E14
LK149	E14
LK151	G10
LK152	G10
LK153	G10
LK154	G10
LK155	F10
LK156	F10
LK157	F10
LK159	F10
LK160	F10
LK161	D14
LK162	D14
LK163	D14
LK164	D14
LK166	E6
LK168	E6
LK169	E6
LK170	E6
LK171	E6
LK172	D6
LK173	E6
LK174	E6
LK175	E6
LK176	E7
LK177	E7
LK178	F8
LK179	E7
LK180	E7
LK181	E7
LK182	D7
LK183	D6
LK184	D7
LK185	C8
LK186	C7
LK187	C7
LK189	C7
LK190	C8
LK191	F7
LK193	F7
LK195	E7
LK196	F7
LK197	E8
LK198	F8
LK199	E7
LK200	F8
LK201	F8
LK202	F8
LK203	E8
LK204	E8
LK205	E8
LK206	F8
LK207	D8
LK208	D8
LK209	D8
LK210	D8
LK211	E9
LK212	F9
LK213	F9
LK216	F9
LK217	F9
LK218	E9
LK221	E9
LK224	E9
LK225	E9
LK226	E9
LK227	E10
LK228	F10
LK230	F10
LK231	E11
LK232	E10
LK233	E11
LK235	D11
LK236	E11
LK237	E12
LK238	E12
LK239	E12
LK240	E12
LK241	E12
LK242	D11
LK244	D11
LK246	D11
LK247	D11
LK248	D12
LK249	C11
LK250	C12
LK251	C12
LK253	B11
LK256	C12
LK257	C12
LK258	C12
LK259	C12
LK260	C11

GRID REFS - IDENT DIAGRAMS FOR MAIN PCB (cont.)

LK262	B9
LK263	B9
LK264	B9
LK265	B9
LK266	B9
LK267	C10
LK268	C10
LK269	C10
LK270	D10
LK271	D10
LK272	D10
LK273	C10
LK274	C10
LK275	C10
LK279	E9
LK280	F10
LK281	E10
LK282	I4
LK283	D3
LK284	F14
LK287	E10
LK290	C12
LK291	C12
LK292	C13
LK293	C13
LK294	D12
LK296	I11
LK297	J14
LK298	J7
LK300	G7
LK303	D11
LK304	D11
LK305	C11
LK306	D12
LK307	C14
LK308	C13
LK309	D10
LK310	F7
LK311	H8
LK312	H8
LK313	H8
LK314	H11
LK315	I5
LK316	I4
LK317	E10
LK318	E11
LK319	E12
LK320	E11

CONNECTORS

PL1	B14
PL2	H7
PL3	H8
PL4	G14
PL5*	H2
PL7	H14
PL10*	H5
PL11*	F6
PL12	I7
PL26*	F12
PL27*	H11
PL30*	C8
PL33*	E9
PL35*	G7
PL38	H2
SK1	B2
SK2	B8
SK3	B10
SK4	B13

TRANSISTORS

Q1	E3
Q2	F5†
Q3	F5†
Q4	I5
Q5	I5†
Q6	H6†
Q7	H6†
Q9	H5†
Q11	H6†
Q12	I7†
Q13	H6†
Q14	F10†
Q15	F9†
Q16	G9†
Q17	G7†
Q29	I11†
Q30	B5†
Q31	C5†
Q32	E5†
Q33	E5†
Q35	C7†
Q36	C8†
Q37	C8†
Q38	C11†
Q40	E10†
Q41	D10†
Q42	D11†
Q43	E5
Q44	E5
Q45	E4†
Q46	E4†
Q47	F5†
Q48	F5†
Q49	D7†
Q50	D7†
Q51	D7†
Q52	C6†
Q53	D8†
Q54	C10†
Q55	C10†
Q56	C10†
Q57	D8†
Q58	D8†
Q59	D9†
Q61	E10†
Q62	D9†
Q63	G9†
Q64	F9†
Q65	G8†
Q72	H6†
Q73	I4
Q74	F7†
Q75	F7†
Q76	E6†
Q77	E6†
Q78	I8
Q98	E8†
Q99	E9†
Q100	E9†
Q101	H9†
Q102	D7†
Q103	F7†
Q104	D14†
Q105	H9†
Q107	E10†
Q108*	E10†
Q109	C8†
Q110	I14†
Q111	I14†
Q112	C11†
Q113	C11†
Q114	I7
Q115	I7†
Q116	E11†

RESISTORS

R1	B3
R2	D2†
R3	D2†
R4	D2†
R5	E3
R6	D2†
R7	E2
R8	E3
R9	E3
R9A	E3
R10	E3†
R11	G2†
R12	G2†
R13	G3†
R14	C10†
R15	F5†
R16	F5†
R17	F5†
R18	E8†
R19	G5†
R20	H3†
R22	I6†
R23	I6†
R24	I6†
R25	H5†
R26	I5
R27	I5†
R28	H5†
R29	H6†
R30	H6†
R31	I6†
R32	H4
R33	H4
R34	I5†
R35	H5†
R36	I10†
R37	H5†
R38	I5†
R39	I8†
R40	F4
R44	H7†
R45	H7†
R46	H7†
R47	H6†
R48	I7†
R49	H6†
R50	H6†
R51	I6†
R52	I6†
R53	I6†
R55	I6†
R60	I7†
R61	H6†
R62	F11†
R63	F10†
R64	F10†
R65	G10†
R66	G9†
R67	G10†
R68	G10†
R69	G10†
R70	G13†
R71	G13†
R72	G11†
R73	G13†
R74	G13†
R75	F13†
R76	I11†
R77	I11†
R78	H11†
R79	H11†
R80	H11†
R81	H11†
R82	H11†
R83	H11†
R85	F7†
R86	G7†
R87	B6†
R88	I11†
R89	I11†
R90	I12†
R91	H12†
R92	G12†
R93	G12†
R94	G12†
R95	I13†
R96	I13†
R97	I13†
R98	I13†
R99	H12†
R100	G12†
R101	H12†
R102	I12†
R103	I6†
R104	I6†
R105	I7†
R106	I7†
R108	C8†
R109	C8†
R110	E2
R111	E11†
R112	E10†
R113	B9†
R114	B9†
R115	I3
R150	E9†
R151	E4†
R154*	H13†
R155*	H13†
R156	I11†
R157	C5†
R158	B5†
R159	B5†
R160	B5†
R161	B5†
R162	B5†
R163	B5†
R164	B5†
R165	B5†
R166	B5†
R167	B5†
R168	B5†
R169	C5†
R170	C5†
R171	C5†
R172	B5†
R173	B5†
R174	C4†
R175*	B4†
R176	B4†
R177	B4†
R178	B4†
R179	B4†
R180	C4†
R181	D4†
R182	C4†
R183	C4†
R184	C5†
R186	D4†
R187	D4†
R188	C5†
R189	C4†
R190	D4†
R191	E5†
R192	D5†
R194	C4†
R195	D4†
R196	C5†
R197	C5†
R198	E4†
R199	E4†
R201	E5†
R203	E5†
R204	E5†
R205	E5†
R206	G10†
R207	G10†
R208	G10†
R210	C13
R211	C12†
R212	D12†
R215	D12†
R216	E12†
R217	B7†
R220	C7†
R222	C8†
R223	C8†
R224	B9†
R227	B7†
R228	B7†
R229	B9†
R230	B9†
R233	C8†
R236	C8†
R237	C8†
R238	C8†
R239	B11†
R240	C11†
R243	C10†
R244	D11†
R245	C11†
R246	C11†
R247	C11†
R250	B13†
R251	B12†
R252	B11†
R255	B13†
R256	D10†
R257	D10†
R258	E10†
R259	E10†
R260	D10†
R261	D10†
R262	E10†
R263	D11†
R264	D11†
R265	D10†
R269	E5†
R270	E5†
R271	E5
R272	E5
R273	B6†
R274	E4†
R275	E4†
R276	F5†
R277	F5†
R278	F5†
R279	F5†
R280	F5†
R281	C7†
R282	D6†
R283	C7†
R284	D7†
R285	D7†
R286	D7†
R287	D7†
R288	D7†
R289	D7†
R290	D7†
R291	H9†
R292	H9†
R293	I9†
R294	H9†
R295	H10†
R296	H9†
R297	H10†
R298	H10†
R299	H10†
R300	H10†
R301	H9†
R304	E7†
R305	D7†
R306	D7†
R307	E8†
R308	E8†
R309	D7†
R310	E7†
R311	D7†
R312	C7†
R313	C7†
R314	E5†
R315	C7†
R316	C6†
R317	C6†
R318	C6†
R319	D8†
R320	D8†
R321	D9†
R322	D8†
R323	C10†
R324	C10†
R325	C10†
R326	C11†
R327	C10†
R328	B9†
R329	C10†
R330	C10†
R331	C11†
R332	D8†
R333	D9†
R334	D8†
R335	D9†
R336	D9†
R337	D9†
R339	E8†
R340	E8†
R342	E10†
R343	E10†
R345	D9†
R346	D9†
R347	H9†
R348	G9†
R349	G9†
R350	F9†
R351	F9†
R352	F9†
R353	G9†
R354	I10†
R355	G9†
R356	F8†
R357	F8†
R358	F8†
R359	F8†
R360	F9†
R361	G9†
R362	G8†
R363	G8†
R364	G8†
R365	I5
R367	F3
R368	E3†
R369	D2†
R370	C8†
R380	C14†
R382	B13†
R383	G8†
R385	I11†
R396	C13†
R397	C13†
R398	C12†
R399	C12†
R400	D8†
R401	D8†
R402	C7†
R404	I7†
R407	G12†
R411	H13†
R413	G13†
R414	G13†
R416	I12†
R417	F11†
R419	I6†
R420	G9†
R421	D10†
R422	F7†
R423*	G7†
R424	F7†
R425	F7†
R426	F6†
R427	E6†
R428	F6†
R429*	G2†
R430	H8†
R431*	G5†
R432	G5†
R433	C12†
R434	B13†
R435	C9†
R436	C9†
R437	G10†
R440	I3†
R442	I9†
R443	I9†
R444	H8†
R445	I8†
R446	I10†
R450*	I14†
R506	G11†
R512	H7†
R515	G6†
R518	B9†
R519	H13†
R520	G4
R521	C8†
R523	I8†
R524	H13†
R526	H12†
R527°	F11†
R528	G12†
R529	H12†
R530	H12†
R532	H12†
R533	H12†
R534	G10†
R535	G10†
R536	I11†
R537	I12†
R538	I12†
R539*	E8†
R540	E8†
R541	G9†
R542	G9†
R543	B12†
R544	B13†
R545	I6†
R546*	D6†
R547*	D7†
R548	D7†
R554	F6†
R555	F7†
R556	F7†
R559	F14†
R560	F6†
R561	E6†
R562	B7†
R563	B7†
R567	B9†
R568	B9†
R569	B9†
R572	G12†
R573	G12†
R574	D8†
R575	D8†
R576	C6†
R577	C6†
R578	B6†
R579	C6†
R580	C6†
R581	C6†
R590	E13†
R592	C10†
R594	E3
R594A	E3
R595	I10†
R596	I6†
R598	F6†
R599	F6†
R600	F7†
R601	F6†
R602	G6†
R603	G7†
R606	G6†
R607	H6†
R612	F5†
R613	F9†
R616	G6†
R617	G6†
R618	H7†
R619	H7†
R620	G7†
R621	I4†
R622	F6†
R623	I9†
R624	I8†
R625	I9†
R631	C11†
R632	C11†
R633	G6†
R634	C7†
R635	G10†
R636	E7†
R637*	E12†
R639	D12†
R640	E12†
R641	E12†
R642	D12†
R643	E12†
R644	D12†
R645	I6
R645A	I6
R646	D14†
R647	E14†
R648	E14†
R649	D14†
R650	E14†
R651	D5†
R652	D14†
R653	F6†
R655	H4†
R656	C10†
R657	H7†
R658	H7†
R659	H7†
R660	F6†
R661	F7†
R662	F7†
R663	F7†
R665	F7†
R666	F7†
R667	D10†
R668	D12†
R671	E10†
R673	I10†
R674	I10†
R675	I10†
R676	G11†
R677	F14†
R680	F6†
R681	F5†
R682	G6†
R684	C14†
R700*	C5†
R703	G11†
R704	G9†
R705	H9†
R706	H10†
R707	H10†
R708	G10†
R709	F6†
R710	E3
R710A	E3
R711	E3
R711A	E3
R712	I8†
R713	F8†
R714	B10†
R715	B9†
R716	E11†
R720	G8†
R721	G8†
R722	F6†
R723	I9†
R724	I8†
R725	I9†

continued on page 52 overleaf

GRID REFS - IDENT DIAGRAMS FOR MAIN PCB (cont.)

R727	D9†	R746	H8†	R766	C8†	R784	B14†	R801*	B13†	R821	D10†	U18	D13	**MISC.**		TST1	I12
R728	E9†	R747	C6†	R767	G6†	R785	B14†	R802	B10†	R822	G7†	U19	E12			TST2*	H13
R729	D9†	R748	C11†	R768	G6†	R787	H7†	R803	D2†			U20	C11	**COMPONENTS**		TST3*	F9
R730	E10†	R749	B11†	R769	G7†	R788	B6†	R804	E3†	**ICS**		U21	E11	CAN*	H12	TUNER1	C6
R731	E10†	R751	B6†	R771	G7†	R789	E9†	R805	I5†	U1	D2	U22*	G7	FS1	B3	X1	G12
R732	E10†	R752	B6†	R772	H8†	R790	F7†	R806	I5†	U2	G2	U25	F6	FS2	I3	X2	E13
R733*	E10†	R754	I7†	R773	H8†	R791	F6†	R807	I5†	U3	I6	U26	D8	M20	J2	X3‡	G6
R734	I6	R755	B14†	R774	H8†	R792	B14†	R809	E9†	U5	G11	U27	G6	MOD1	C5	X4	I10
R735	B7†	R758	C14†	R775	B8†	R793	B14†	R810	E14†	U6	F13	U29	F9	REG1	H4	X5	F8
R738	C8†	R759	C14†	R776	B8†	R794	D10†	R811	G14†	U7	I10	U30	E11	T1	C3	X6	F14
R740	I14†	R760	B12†	R777	D11†	R795	C7†	R812	D12†	U8	I12	U31	G5	T3	G3	X7*	D9
R741	I14†	R761	C12†	R778	D11†	R797	F5†	R813	H10†	U9	H13	U32	I9	T4*	G3		
R742	I14†	R763	I11†	R780	G14†	R798	G6†	R818	E11†	U15	C5						
R743	I14†	R764	G6†	R781	C13†	R799	E4†	R819	E11†	U16	D5						
R745	H2	R765	D10†	R782	C13†	R800*	G10†	R820	E13†	U17	G10						

Notes: (i) T4 is a substitute transformer for T3 in some instances (different pitch)
(ii) M20 is the source of audio ground

GRID REFS - IDENT DIAGRAMS FOR DISPLAY PCB

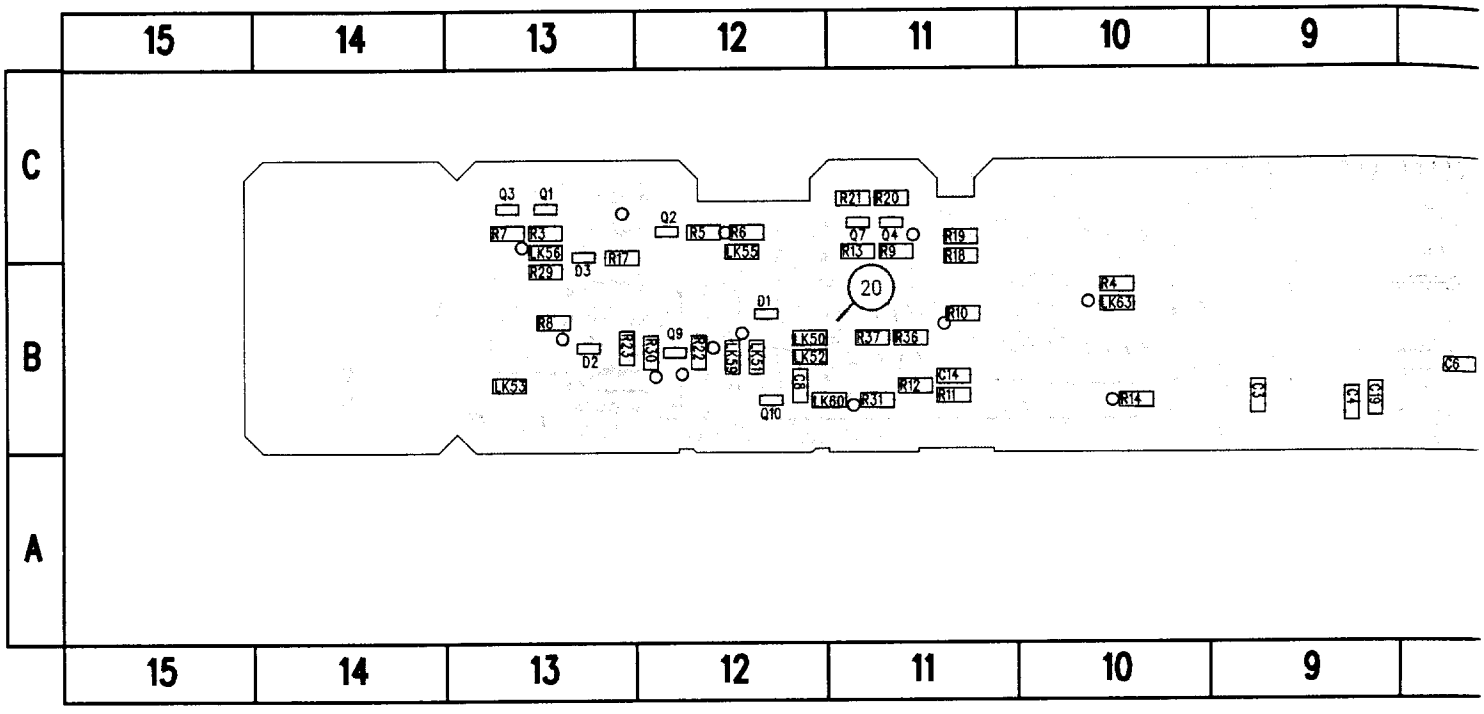
* = not fitted
† = mounted on copper (SMD) side of PCB

CAPACITORS

C1	C5	C19	B9†	**LINKS**		LK21	B6	LK42	B11	**CONNECTORS**		**RESISTORS**		R20	C11†	**SWITCHES**	
C2	B11	C20	B3†	J1	B7†	LK22	B7	LK43	B11	PL1	B4	R1	C5†	R21	C11†	SW1	B13
C3	B9†	C21	C3†	LK1	B3	LK23	C7	LK44	B11	PL2	B13	R2	B2†	R22	B12†	SW2	B2
C4	B9†	C22	B3	LK3	B3	LK24	C8	LK45	C12	PL3	B14	R3	C13†	R23	B13†	SW3	B13
C5	B4			LK4	B3	LK25	B9	LK46	B12			R4	B10†	R24	B7†	SW4	C13
C6	B8†	**DIODES**		LK5	B3	LK26	B9	LK47	C12	**TRANSISTORS**		R5	C12†	R25	B7†	SW5	B14
C7	B6†	D1	B12†	LK6	B3	LK27	C9	LK48	B13	Q1	C13†	R6	C12†	R26	C2†		
C8	B12†	D2	B13†	LK8	B3	LK28	C9	LK49	B13	Q2	C12†	R7	C13†	R27	C2†	**ICS**	
C10	B2†	D3	C13†	LK9	B4	LK29	C9	LK50	B12†	Q3	C13†	R8	B13†	R29	B13†	U1	B7
C11	B2	D4	B2†	LK10	B4	LK30	C9	LK51	B12†	Q4	C11†	R9	C11†	R30	B12†		
C12	B5	D5	B3	LK11	B4	LK31	B9	LK52	B12†	Q5	B11	R10	B11†	R31	B11†	**MISC.**	
C14	B11†			LK12	B4	LK32	B9	LK53	B13†	Q6	B11	R11*	B11†	R32	C5†	**COMPONENTS**	
C15	B7†	**INDUCTORS**		LK13	B4	LK33	B10	LK54	B7†	Q7	C11†	R12*	B11†	R33	C5†	IR1	B5
C16	B7†	L1	B5	LK14	B4	LK34	B10	LK55	C12†	Q8	B2†	R13	C11†	R34	C5†	LED1	B12
C17	B8†			LK15	B4	LK35	B10	LK56	C13†	Q9	B12†	R14	B10†	R36	B11†	LED2	B12
C18	C4			LK16	B4	LK36	B10	LK58	B7†	Q10	B12†	R15	B8†	R37	B11†	LED3*	B2
				LK17	B4	LK37	B10	LK59	B12†			R16	B7†	R38	B3	VFD1	B8
				LK18	B5	LK38	B10	LK60	B11†			R17	C13†			X1	B9
				LK19	B5	LK39	B10	LK61	B4†			R18	C11†				
				LK20	B6	LK40	B10	LK62	B3†			R19	C11†				
						LK41	B10	LK63	B10†								

DISPLAY BOARD IDENT DIAGRAMS

SURFACE MOUNT SIDE OF PCB



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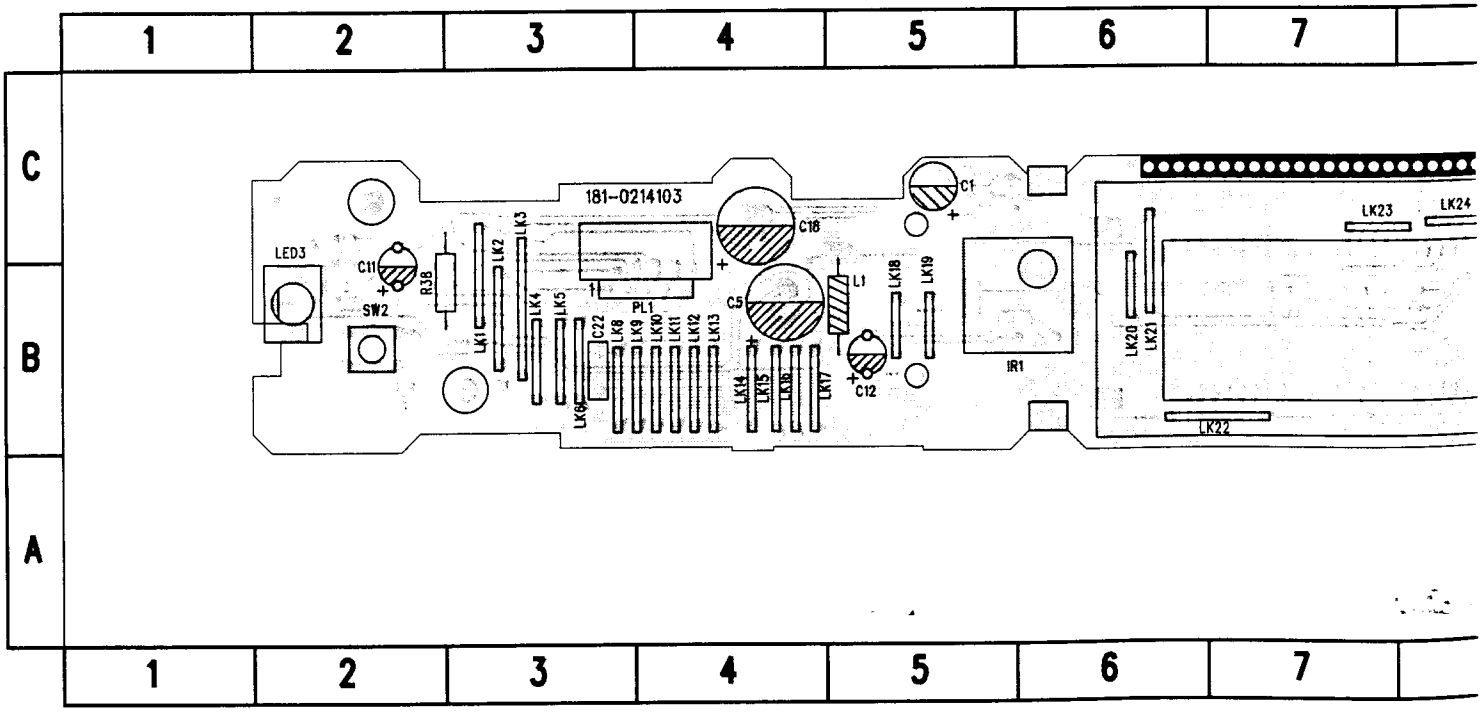
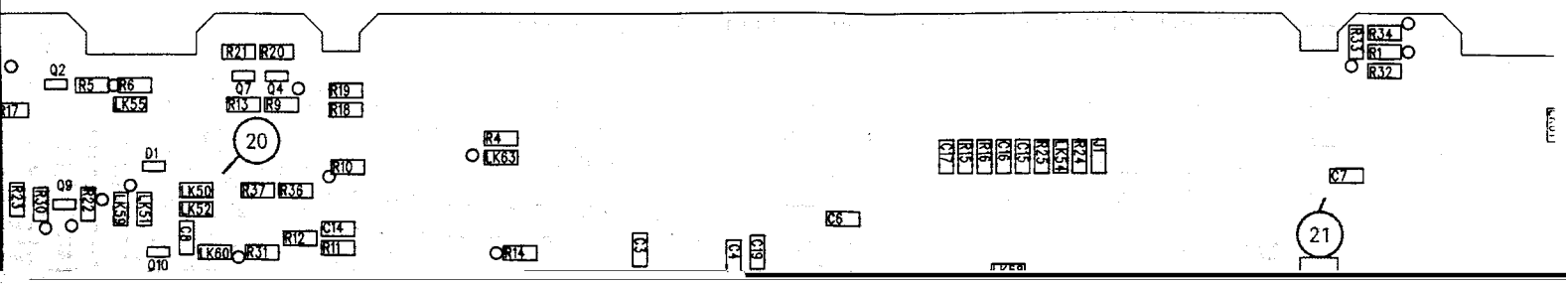
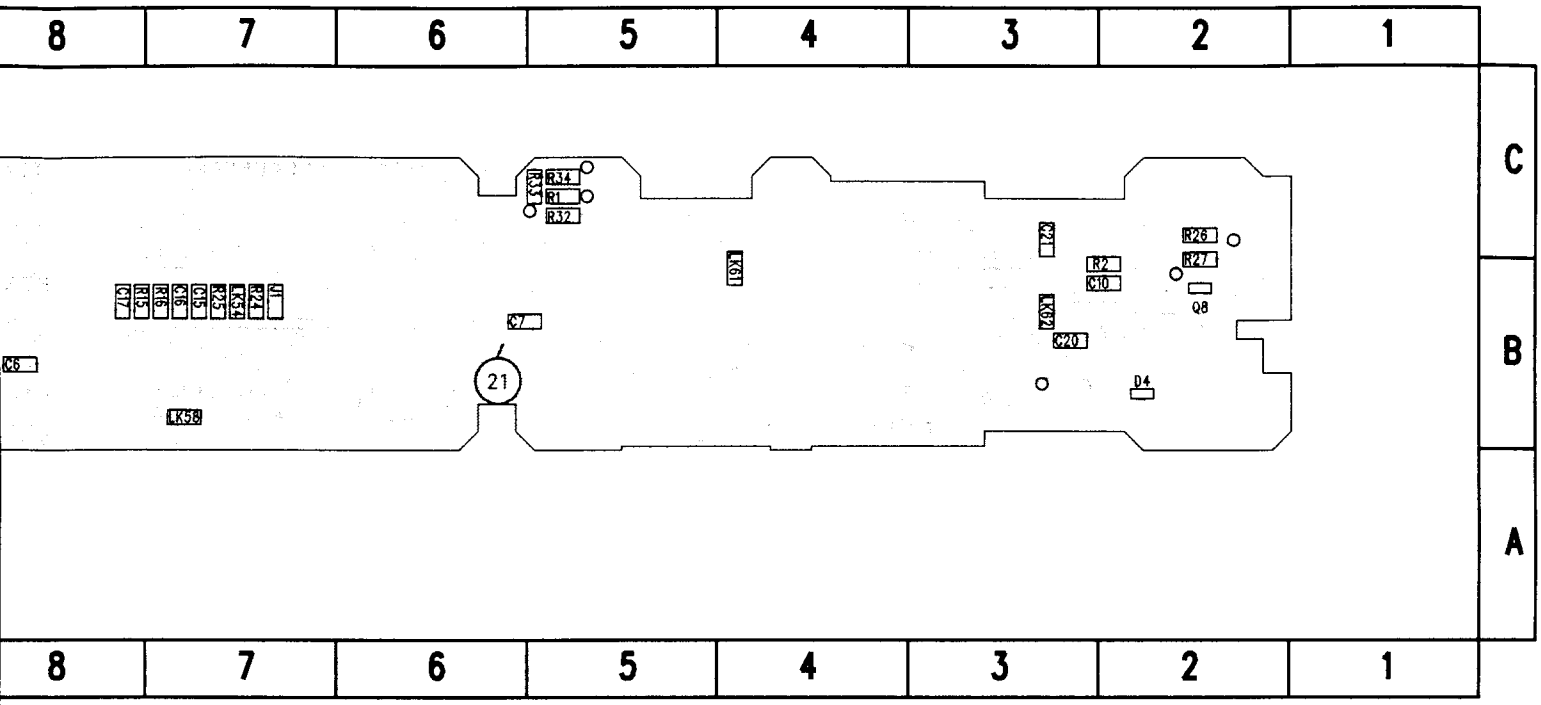
8 Cherry Tree Road, Chinnor
Oxfordshire, OX9 4QY.
Tel (01844) 351694
Fax (01844) 352554
email:- mauritron@dial.pipex.com

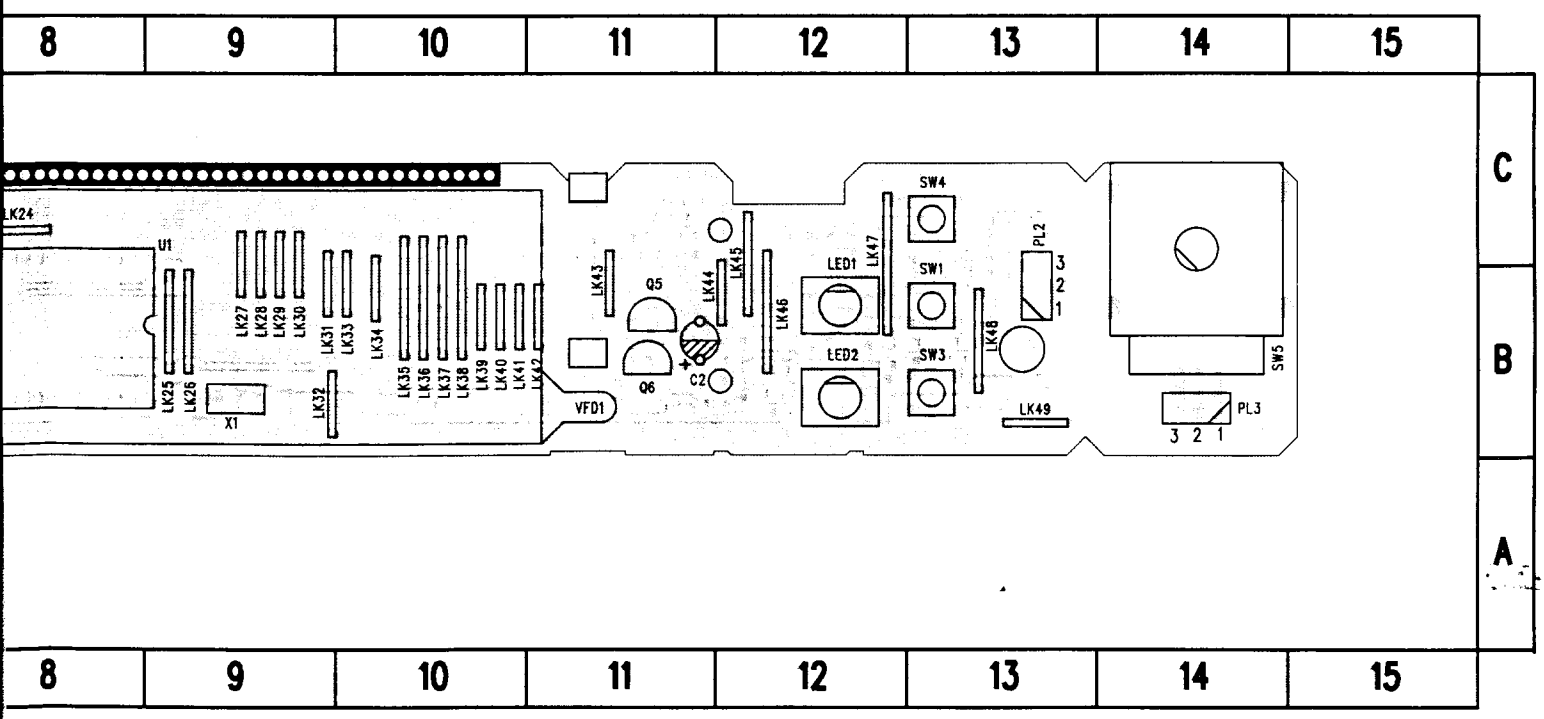
COMPONENT IDENT SIDE OF PCB



12	11	10	9	8	7	6	5




8
7
6
5
4
3
2
1
C
B
A
R34
R1
R32
R33
LK61
C22
R2
C10
R26
R27
Q8
C23
C20
D4
C27
R15
R16
C6
C15
R25
LK59
R24
U1
C7
C6
21
LK58


8
9
10
11
12
13
14
15
C
B
A
LK24
U1
LK27
LK28
LK29
LK30
LK31
LK33
LK34
LK35
LK36
LK37
LK38
LK39
LK40
LK41
LK42
LK25
LK26
X1
LK32
LK43
Q5
LK44
LK45
LK46
Q6
C2
VFD1
SW4
LED1
LK47
SW1
LED2
SW3
LK48
LK49
PL2
SW5
PL3
3 2 1

GRID REFS FOR SOUND BOARD IDENT DIAGRAMS

SEE PAGES 54 & 55 FOR IDENT DIAGRAMS (FOLD THIS PAGE OVER TO SEE REFS AND DIAGRAMS SIMULTANEOUSLY)

* = not fitted

† = component on copper (SMD) side of PCB

CAPACITORS

C1	E2
C2	E5
C3	D2†
C4	D2†
C5	D2†
C6	D2
C7	E3†
C8	E3†
C9	D3†
C10	E3†
C11	E3†
C12	E3†
C13	E3†
C14	E3†
C15	E3†
C16	E3†
C17	D8
C18	E4
C19	E4
C20	D4†
C21	C4†
C22	C4†
C23	D4†
C24	D5†
C25	D5†
C26	E3
C27	E3
C28	D3†
C29	D3†
C30	D9†
C31	B4
C32*	D6
C33	C6†
C34	D4†
C35	D4†
C36	D4†
C37	D3†
C38	D3†
C39	D3†
C40	D3†
C41	B4†
C42	B3
C43	C3
C44	B3†
C45	C3
C46	B4†
C47	C4
C48	C4†
C49	B6†
C50	C6†
C51	C4
C52	C6†
C53	C5†
C54	B4
C55*	D6
C56	F2†
C57	B3†
C58	E4†
C59	C4†
C60	C5†
C61	E6
C62	D4†
C63	E3†
C64	E6†
C65	E6†
C66	C10
C67	C10
C68	C9
C69	C10†
C70	D10
C71	D10†
C72	D10
C73	B9†
C74	C9
C75*	E9
C76	D5
C77	C8
C78	C8
C79	C7
C80	C7†
C81	E8
C82	C7†
C83	E7
C84	B7†
C85	C7
C86	C10
C87	D5†
C88	D4†
C89	D9†
C90	E4
C91	D9†
C92*	D9
C93	C9
C94	D9†
C95	D9
C96	D8†
C97	D7
C98	D8†
C99*	E8
C100	C8
C101	D8†
C102	D7†
C103	E8
C104	D6
C105	D8†
C106	D7
C109	D6†
C110	D7†
C111	F5
C112	E5†
C120	D3†
C121	D2†
C122	D9†
C123	D7†
C124	C6†
C125*	B5†
C126*	B6†
C127*	B5†
C128*	F5†

DIODES

D1	C10†
D2	B10†
D3	D3†
D4	E2†
D5	E2†
D6	E4†
D7	E3†
D8	D2†
D9	E5†
D10	D6†

LINKS

J1	E9
J2	E9
J3*	E8
J4	D8
J5	D6
J6	D6
J7	B4†
J8*	B4†
J9*	D5†
J10	E5†
J11*	E5†
LK1	F4
LK2	D3
LK3	C3
LK4	C2
LK5	D8
LK6	D7
LK7	D7
LK8	D7
LK9	C7
LK10	C7
LK11	C4
LK12	C5
LK13	D4
LK14	D3
LK15	D3
LK16	C4
LK17	D4
LK18	D4
LK19	E4
LK20	E4
LK21	F4
LK22	B3
LK23	C2
LK24	D3
LK25	D3
LK26	D3
LK27	D3
LK28	C4
LK29	C4
LK30	C4
LK31	C4
LK32	C4
LK33	B4
LK34	C4
LK35	C5
LK36	C5
LK37	C5
LK38	C4
LK39	C5
LK40	D5
LK41	D6
LK42	D6
LK43	D5
LK44	D5
LK45	D5
LK46	D5
LK47	D2†
LK49	C6
LK51	C7
LK52	D7
LK53	E2
LK54	C7
LK55	D8
LK56	D8
LK57	D8
LK58	D9
LK59	D9
LK64	E9
LK65	C9
LK66	D9
LK67	C9
LK68	D9
LK70	D7
LK71	E7
LK72	E7
LK73	D6
LK75	D6
LK76	D5
LK77	D5
LK78	E5
LK79	D3
LK80	D3
LK81	E4
LK82	E4
LK83	F3
LK84	F3
LK85	E2
LK86	C10
LK87	C10
LK88	D8
LK89	C6
LK90	C6
LK92	E10
LK93	C6
LK95	C3
LK96	E8†
LK97	E6†
LK98	E7†
LK99	E8†
LK100	D7†
LK101	D8†
LK102	D8†
LK103	D5†
LK104	D7†
LK105	D9
LK107	C8
LK108	C8
LK109	C9
LK110	C8
LK111	C6
LK112	C7
LK113	C10
LK114	C10
LK115	B7†
LK116	B7†
LK117	B8†
LK118*	B5
LK119*	B4
LK120*	B3
LK121*	F2†

CONNECTORS

PL1	E10
PL2	E6
PL3	F2
PL4	D8
PL5*	F5
PL6*	E10
PL7*	F2
PL8*	E6
SK1	C11

TRANSISTORS

Q1	D4†
Q2	D4†
Q3	C10†
Q4	B10†
Q5	D4†
Q6	B10†
Q7	C6†
Q8	C6†
Q9	D8†
Q10	D9†
Q11	E2†
Q12*	B10†
Q13*	F2†

RESISTORS

R1	B4†
R2	D2†
R3	D2†
R4	D2†
R5	E3†
R6	E3†
R7	E4†
R8	E3†
R9	E3†
R10	E3†
R11	F3†
R12	E4†
R13	E3†
R14	E3†
R15	C10†
R16	B10†
R17	C10†
R18	C10†
R19	D4†
R20	C4†
R21	C4†
R22	C4†
R23	D4†
R24	D5†
R25	D4†
R26	D4†
R27	D4†
R28	D4†
R29	D4†
R30	D4†
R31	B4†
R32	B3†
R33	B3†
R34	B4†
R35	B4†
R36	C5†
R37	D3†
R38	C6†
R39	C5†
R40	C5†
R41	B5†
R42	B5†
R43	B5†
R44	C5†
R45	C5†
R46	C5†
R47	C6†
R48	C6†
R49	C5†
R50	C8†
R51	C6†
R52	B10†
R53	C5†
R54	C5†
R55	D2†
R56	E2†
R57	E2†
R58	E2†
R59	D4†
R60	D4†
R61*	D6†
R62*	D6†
R63	E4†
R64	E4†
R65	F4†
R66	F4†
R73	D5†
R78	C10†
R79	D10†
R82	D2†
R83	D5†
R84	C7†
R85	C7†
R86*	B5†
R87*	B5†
R88*	B5†
R89	D6†
R90*	B6†
R91*	B10†
R92*	B10†
R93*	B5†
R94*	B5†
R95*	B5†
R96*	E2†
R97*	F2†
R105	D5†
R106	C4†
R107	C6†
R108	D8†

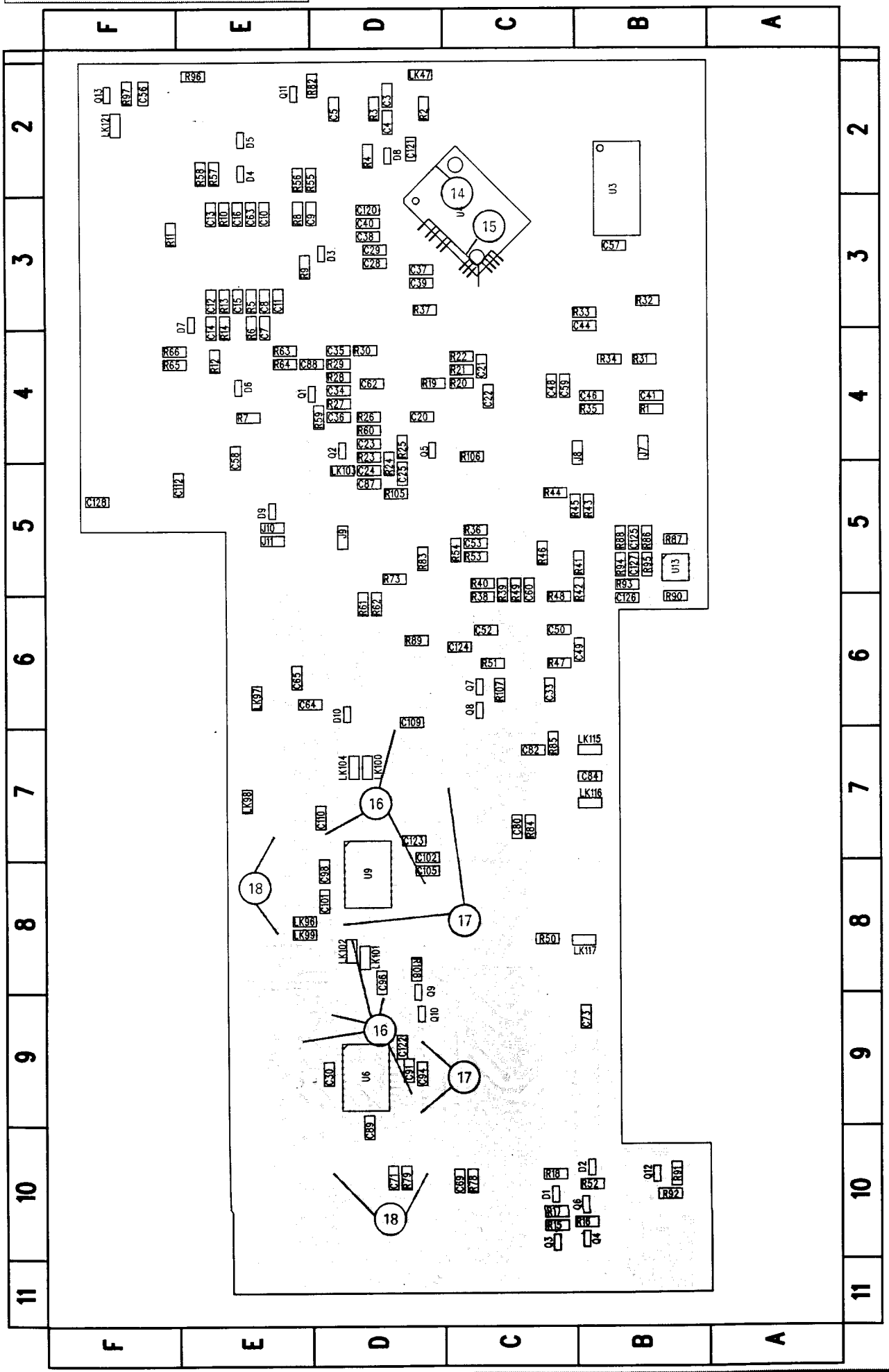
ICS

U1	B4
U2	D6
U3	B2†
U4	C3†
U5	C6
U6	D9†
U7	D4
U8	E3
U9	D8†
U10	C5
U11	C9
U12	C7
U13*	B5†

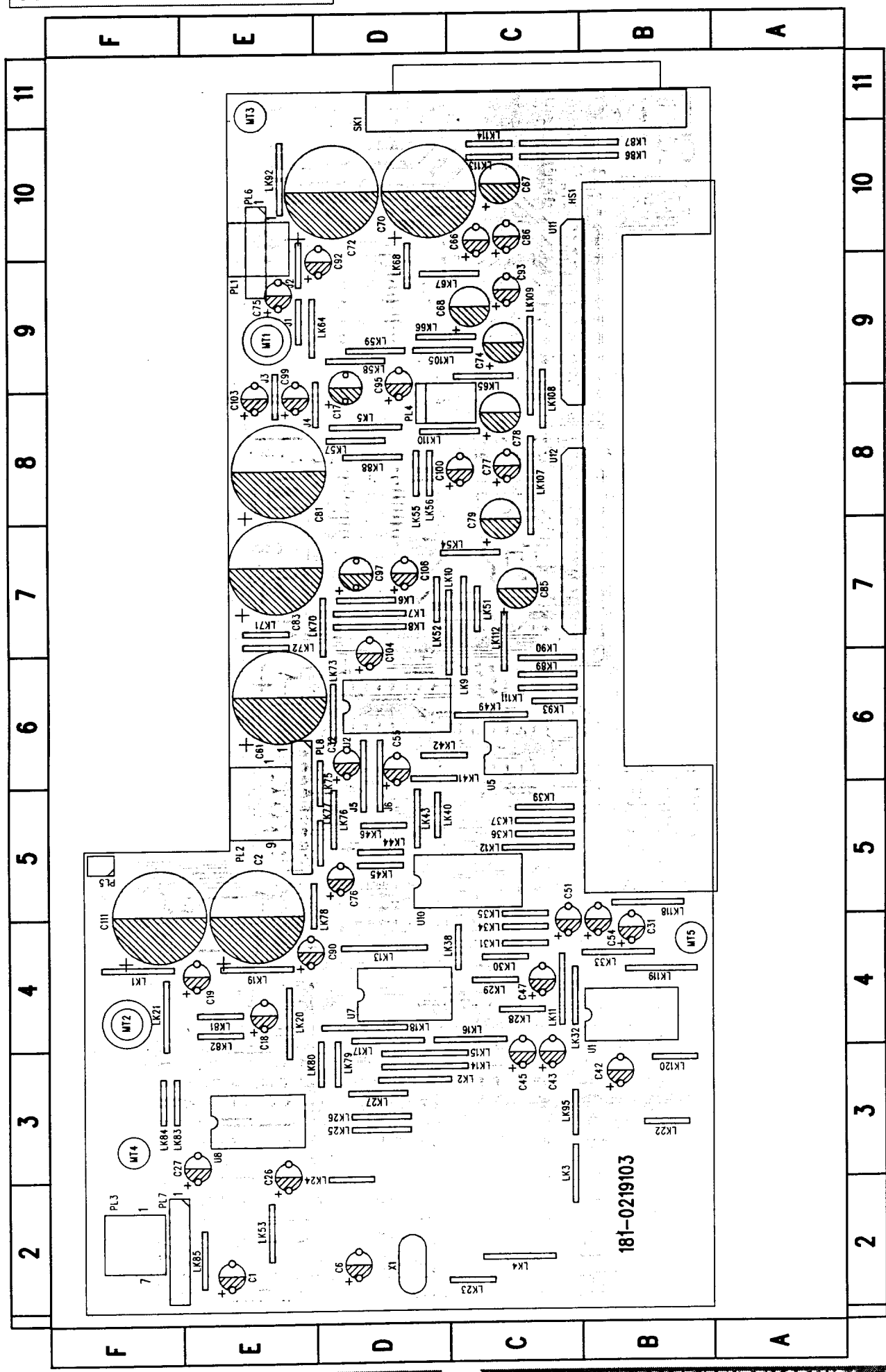
MISC. COMPONENTS

HS1	B7
X1	D2

SURFACE MOUNT SIDE OF PCB



COMPONENT IDENT SIDE OF PCB



SPARES - ELECTRICAL PARTS LIST FOR MAIN BOARD

NOTE: ⚠ indicates a safety-critical component; these must only be replaced by components of the correct type as listed in these parts lists.

Capacitors

C1	CLASS X CAP-100NF 250V 20%	159-1048780
C2	100UF 400V +-20% 10MM 105 RAD ELEC CAP	855-1079780
C3	SMD 1NF 50V 5% CER COG CAP 0805 (TRS)	950-1025501
C4	SMD 2.2NF 50V 5% CER COG CAP 0805 (TRS)	950-2225501
C5	10UF 35V 20% 105DEG RADIAL ELECT' CAP	855-1063751
C6	100UF 25V 20% 105DEG RADIAL ELECT' CAP	855-1072751
C7	CER CAP 2.2NF 1KV 10% 7.5MM HR SERIES	159-2229660
C8	SMD 18PF 50V 5% CER COG CAP 0805 (TRS)	950-1805501
C9	220NF 50V 10% M/LAYER CER CAP TR	157-2245651
C10	100UF 35V DJ3 RADIAL ELECT' CAP	855-1073951
C11	1000UF 25V DJ3 RADIAL ELECT CAP 5MM	855-1082950
C12	1000UF 25V DJ3 RADIAL ELECT CAP 5MM	855-1082950
C13	100UF 50V DJ3 -20+80% 5MM RADIAL CAP	855-1075950
C14	10UF 25V 5MM RADIAL ELECT' CAP TR	155-1062751
C15	1000UF 16V 5MM RAD ELEC' CAP (10X16)	155-1081750
C16	SMD 0.1UF 25V 20/80% CER Y5V CAP 0805 TR	950-1042951
C18	SMD 47NF 50V 10% CER X7R CAP 0805 (TRS)	950-4735621
C19	SMD 47NF 50V 10% CER X7R CAP 0805 (TRS)	950-4735621
C20	SMD 47NF 50V 10% CER X7R CAP 0805 (TRS)	950-4735621
C21 ⚠	"A" CLASS Y CAP-1NF 250V 20% (TDK,MUR)	159-1028781
C22	SMD 47NF 50V 10% CER X7R CAP 0805 (TRS)	950-4735621
C24	SMD 3.3NF 50V 5% CER X7R CAP 0805 (TRS)	950-3325521
C25	SMD 3.3NF 50V 5% CER X7R CAP 0805 (TRS)	950-3325521
C27	SMD 220NF 25V 20/80% CER Y5V CAP 0805 TR	950-2242951
C28	SMD 100PF 50V 5% CER COG CAP 0805 (TRS)	950-1015501
C29	SMD 10NF 50V 10% CER X7R CAP 0805 (TRS)	950-1035621
C30	SMD 0.1UF 25V 20/80% CER Y5V CAP 0805 TR	950-1042951
C31	SMD 0.1UF 25V 20/80% CER Y5V CAP 0805 TR	950-1042951
C32	SMD 10NF 50V 10% CER X7R CAP 0805 (TRS)	950-1035621
C33	SMD 22PF 50V 5% CER COG CAP 0805 (TRS)	950-2205501
C34	SMD 22NF 50V 10% CER X7R CAP 0805 (TRS)	950-2235621
C35	SMD 33PF 50V 5% CER COG CAP 0805 (TRS)	950-3305501
C38	SMD 22PF 50V 5% CER COG CAP 0805 (TRS)	950-2205501
C39	SMD 47PF 50V 5% CER COG CAP 0805 (TRS)	950-4705501
C40	SMD 56PF 50V 5% CER COG CAP 0805 (TRS)	950-5605501
C42	SMD 5.6PF 50V +-0.25PF CER COG CAP 0805	950-0565301
C44	SMD 22NF 50V 10% CER X7R CAP 0805 (TRS)	950-2235621
C45	SMD 220NF 25V 20/80% CER Y5V CAP 0805 TR	950-2242951
C50	SMD 330NF 25V 20/80% CER Y5V CAP 0805 TR	950-3342951
C51	SMD 330NF 25V 20/80% CER Y5V CAP 0805 TR	950-3342951
C52	SMD 150PF 50V 5% CER COG CAP 0805 (TRS)	950-1515501
C54	22UF 35V 5MM RADIAL ELECT' CAP	155-2263751
C55	SMD 56PF 50V 5% CER COG CAP 0805 (TRS)	950-5605501
C56	SMD 27PF 50V 5% CER COG CAP 0805 (TRS)	950-2705501
C57	SMD 56PF 50V 5% CER COG CAP 0805 (TRS)	950-5605501
C58	SMD 12PF 50V 5% CER COG CAP 0805 (TRS)	950-1205501
C59	SMD 12PF 50V 5% CER COG CAP 0805 (TRS)	950-1205501
C60	SMD 220PF 50V 5% CER COG CAP 0805 (TRS)	950-2215501
C61	SMD 220PF 50V 5% CER COG CAP 0805 (TRS)	950-2215501
C62	SMD 22PF 50V 5% CER COG CAP 0805 (TRS)	950-2205501
C63	SMD 220PF 50V 5% CER COG CAP 0805 (TRS)	950-2215501
C64	SMD 220PF 50V 5% CER COG CAP 0805 (TRS)	950-2215501
C65	SMD 220NF 25V 20/80% CER Y5V CAP 0805 TR	950-2242951
C66	SMD 220PF 50V 5% CER COG CAP 0805 (TRS)	950-2215501
C70	SMD 4.7PF 50V +-0.25PF CER COG CAP 0805	950-0475301
C71	SMD 4.7PF 50V +-0.25PF CER COG CAP 0805	950-0475301
C72	SMD 1.5PF 50V +-0.25PF CER COG CAP 0805	950-0155301
C73	SMD 1.5PF 50V +-0.25PF CER COG CAP 0805	950-0155301
C74	SMD 1.5PF 50V +-0.25PF CER COG CAP 0805	950-0155301
C75	SMD 1.5PF 50V +-0.25PF CER COG CAP 0805	950-0155301
C76	SMD 12PF 50V 5% CER COG CAP 0805 (TRS)	950-1205501
C77	SMD 100PF 50V 5% CER COG CAP 0805 (TRS)	950-1015501
C78	SMD 1NF 50V 5% CER COG CAP 0805 (TRS)	950-1025501
C79	SMD 22NF 50V 10% CER X7R CAP 0805 (TRS)	950-2235621
C80	SMD 1NF 50V 5% CER COG CAP 0805 (TRS)	950-1025501
C81	SMD 220NF 25V 20/80% CER Y5V CAP 0805 TR	950-2242951
C82	SMD 180PF 50V 5% CER COG CAP 0805 TR	950-1815501
C83	SMD 1NF 50V 5% CER COG CAP 0805 (TRS)	950-1025501
C85	SMD 100PF 50V 5% CER COG CAP 0805 (TRS)	950-1015501
C86	SMD 330NF 25V 20/80% CER Y5V CAP 0805 TR	950-3342951
C87	SMD 1NF 50V 5% CER COG CAP 0805 (TRS)	950-1025501
C88	SMD 220PF 50V 5% CER COG CAP 0805 (TRS)	950-2215501
C89	SMD 1NF 50V 5% CER COG CAP 0805 (TRS)	950-1025501
C90	SMD 1NF 50V 5% CER COG CAP 0805 (TRS)	950-1025501
C91	330NF 25V 5MM CERAMIC CAP TR	150-3342951
C92	SMD 1NF 50V 5% CER COG CAP 0805 (TRS)	950-1025501
C93	SMD 1NF 50V 5% CER COG CAP 0805 (TRS)	950-1025501
C94	SMD 220NF 25V 20/80% CER Y5V CAP 0805 TR	950-2242951
C95	SMD 330PF 50V 10% CER COG CAP 0805 (TRS)	950-3315601
C96	SMD 150PF 50V 5% CER COG CAP 0805 (TRS)	950-1515501
C97	SMD 0.1UF 25V 20/80% CER Y5V CAP 0805 TR	950-1042951
C98	SMD 1NF 50V 5% CER COG CAP 0805 (TRS)	950-1025501
C100	SMD 10NF 50V 10% CER X7R CAP 0805 (TRS)	950-1035621
C101	22UF 35V 5MM RADIAL ELECT' CAP	155-2263751
C102	SMD 0.1UF 25V 20/80% CER Y5V CAP 0805 TR	950-1042951
C103	1UF 35V 5MM RADIAL ELECT' CAP TR	155-1053751
C104	1UF 50V 5MM M/LAYER CER.CAP TR	157-1055751
C106	SMD 1NF 50V 5% CER COG CAP 0805 (TRS)	950-1025501
C107	10UF 35V 5MM RADIAL ELECT' CAP TR	155-1063751
C108	SMD 0.1UF 25V 20/80% CER Y5V CAP 0805 TR	950-1042951
C109	SMD 56PF 50V 5% CER COG CAP 0805 (TRS)	950-5605501
C110	SMD 220NF 25V 20/80% CER Y5V CAP 0805 TR	950-2242951
C111	10UF 16V 5MM RADIAL ELECT' CAP TR	155-1061751
C112	SMD 0.1UF 25V 20/80% CER Y5V CAP 0805 TR	950-1042951
C113	SMD 10PF 50V 5% CER CAP 0805 (TRS)	950-1005501
C114	SMD 10PF 50V 5% CER CAP 0805 (TRS)	950-1005501
C115	SMD 470PF 50V 10% CER X7R CAP 0805 (TRS)	950-4715621
C116	SMD 470PF 50V 10% CER X7R CAP 0805 (TRS)	950-4715621
C117	3.3UF 16V 5MM RADIAL ELECT' CAP TR	155-3351751
C118	SMD 0.1UF 25V 20/80% CER Y5V CAP 0805 TR	950-1042951
C119	SMD 0.1UF 25V 20/80% CER Y5V CAP 0805 TR	950-1042951
C120	SMD 1NF 50V 5% CER COG CAP 0805 (TRS)	950-1025501
C121	SMD 1NF 50V 5% CER COG CAP 0805 (TRS)	950-1025501
C122	10UF 16V 5MM RADIAL ELECT' CAP TR	155-1061751
C123	10UF 16V 5MM RADIAL ELECT' CAP TR	155-1061751
C124	SMD 1NF 50V 5% CER COG CAP 0805 (TRS)	950-1025501
C125	SMD 1NF 50V 5% CER COG CAP 0805 (TRS)	950-1025501
C126	SMD 2.2NF 50V 5% CER COG CAP 0805 (TRS)	950-2225501
C127	SMD 2.2NF 50V 5% CER COG CAP 0805 (TRS)	950-2225501
C128	10UF 16V 5MM RADIAL ELECT' CAP TR	155-1061751
C130	SMD 220PF 50V 5% CER COG CAP 0805 (TRS)	950-2215501
C131	10UF 16V 5MM RADIAL ELECT' CAP TR	155-1061751
C132	10UF 16V 5MM RADIAL ELECT' CAP TR	155-1061751
C133	10UF 16V 5MM RADIAL ELECT' CAP TR	155-1061751
C134	10UF 16V 5MM RADIAL ELECT' CAP TR	155-1061751
C135	10UF 16V 5MM RADIAL ELECT' CAP TR	155-1061751
C136	10UF 16V 5MM RADIAL ELECT' CAP TR	155-1061751
C137	10UF 16V 5MM RADIAL ELECT' CAP TR	155-1061751
C138	10UF 16V 5MM RADIAL ELECT' CAP TR	155-1061751
C139	10UF 16V 5MM RADIAL ELECT' CAP TR	155-1061751
C140	10UF 16V 5MM RADIAL ELECT' CAP TR	155-1061751
C141	10UF 16V 5MM RADIAL ELECT' CAP TR	155-1061751
C142	10UF 16V 5MM RADIAL ELECT' CAP TR	155-1061751
C143	10UF 16V 5MM RADIAL ELECT' CAP TR	155-1061751
C144	10UF 16V 5MM RADIAL ELECT' CAP TR	155-1061751
C145	10UF 16V 5MM RADIAL ELECT' CAP TR	155-1061751
C146	10UF 16V 5MM RADIAL ELECT' CAP TR	155-1061751
C147	10UF 16V 5MM RADIAL ELECT' CAP TR	155-1061751
C148	SMD 0.1UF 25V 20/80% CER Y5V CAP 0805 TR	950-1042951

SPARES - ELECTRICAL PARTS LISTS FOR MAIN BOARD (cont.)

C149	100UF 16V 5MM RADIAL ELECT' CAP TR	155-1071751
C153	220UF 16V 5MM RADIAL ELECT' CAP TR	155-2271751
C154	SMD 0.1UF 25V 20/80% CER Y5V CAP 0805 TR	950-1042951
C158	100UF 16V 5MM RADIAL ELECT' CAP TR	155-1071751
C159	SMD 0.1UF 25V 20/80% CER Y5V CAP 0805 TR	950-1042951
C160	100UF 16V 5MM RADIAL ELECT' CAP TR	155-1071751
C161	10UF 16V 5MM RADIAL ELECT' CAP TR	155-1061751
C162	100UF 16V 5MM RADIAL ELECT' CAP TR	155-1071751
C163	SMD 39PF 50V 5% CER COG CAP 0805 (TRS)	950-3905501
C164	SMD 0.1UF 25V 20/80% CER Y5V CAP 0805 TR	950-1042951
C165	4.7UF 16V 5MM RADIAL ELECT' CAP TR	155-4751751
C166	SMD 0.1UF 25V 20/80% CER Y5V CAP 0805 TR	950-1042951
C167	SMD 0.1UF 25V 20/80% CER Y5V CAP 0805 TR	950-1042951
C168	22UF 16V 5MM RADIAL ELECT' CAP TR	155-2261751
C169	2.2UF 16V 5MM RADIAL ELECT' CAP TR	155-2251751
C170	SMD 12PF 50V 5% CER COG CAP 0805 (TRS)	950-1205501
C171	SMD 12PF 50V 5% CER COG CAP 0805 (TRS)	950-1205501
C172	SMD 220NF 25V 20/80% CER Y5V CAP 0805 TR	950-2242951
C173	10UF 16V 5MM RADIAL ELECT' CAP TR	155-1061751
C174	SMD 33PF 50V 5% CER COG CAP 0805 (TRS)	950-3305501
C175	SMD 33PF 50V 5% CER COG CAP 0805 (TRS)	950-3305501
C176	100UF 16V 5MM RADIAL ELECT' CAP TR	155-1071751
C177	470UF 16V 5MM RADIAL ELECT' CAP TR	155-4771751
C178	SMD 47PF 50V 5% CER COG CAP 0805 (TRS)	950-4705501
C179	SMD 0.1UF 25V 20/80% CER Y5V CAP 0805 TR	950-1042951
C180	SMD 390PF 50V 2% CER COG CAP 0805 (TR)	950-3915201
C181	SMD 390PF 50V 2% CER COG CAP 0805 (TR)	950-3915201
C182	SMD 100PF 50V 2% CER COG CAP 0805 (TR)	950-1015201
C184	100UF 16V 5MM RADIAL ELECT' CAP TR	155-1071751
C185	10UF 16V 5MM RADIAL ELECT' CAP TR	155-1061751
C186	10UF 16V 5MM RADIAL ELECT' CAP TR	155-1061751
C187	1UF 50V 5MM BOX POLYESTER CAP TR	152-1055651
C188	SMD 10NF 50V 10% CER X7R CAP 0805 (TRS)	950-1035621
C189	SMD 82PF 50V 5% CER COG CAP 0805 (TRS)	950-8205501
C190	SMD 56PF 50V 5% CER COG CAP 0805 (TRS)	950-5605501
C191	SMD 56PF 50V 2% CER COG CAP 0805 (TR)	950-5605201
C192	SMD 180PF 50V 2% CER.CAP 0805 (TRS)	950-1815201
C194	470NF 63V 5MM BOX POLYESTER CAP TR	152-4746651
C196	10UF 16V 5MM RADIAL ELECT' CAP TR	155-1061751
C198	10UF 16V 5MM RADIAL ELECT' CAP TR	155-1061751
C199	SMD 18PF 50V 5% CER COG CAP 0805 (TRS)	950-1805501
C200	1UF 50V 5MM BOX POLYESTER CAP TR	152-1055651
C201	10UF 16V 5MM RADIAL ELECT' CAP TR	155-1061751
C202	SMD 4.7NF 50V 10% CER X7R CAP 0805 (TRS)	950-4725621
C203	SMD 33NF 25V 10% CER X7R CAP 0805 (TRS)	950-3332621
C204	4.7UF 16V 5MM RADIAL ELECT' CAP TR	155-4751751
C205	SMD 3.3NF 50V 5% CER X7R CAP 0805 (TRS)	950-3325521
C206	SMD 220NF 25V 20/80% CER Y5V CAP 0805 TR	950-2242951
C207	SMD 220NF 25V 20/80% CER Y5V CAP 0805 TR	950-2242951
C208	1UF 16V 5MM RADIAL ELECT' CAP TR	155-1051751
C209	SMD 220NF 25V 20/80% CER Y5V CAP 0805 TR	950-2242951
C210	SMD 100PF 50V 5% CER COG CAP 0805 (TRS)	950-1015501
C211	SMD 68PF 50V 5% CER COG CAP 0805 (TRS)	950-6805501
C212	SMD 27PF 50V 5% CER COG CAP 0805 (TRS)	950-2705501
C213	SMD 1NF 50V 5% CER COG CAP 0805 (TRS)	950-1025501
C214	SMD 1NF 50V 5% CER COG CAP 0805 (TRS)	950-1025501
C215	SMD 22PF 50V 5% CER COG CAP 0805 (TRS)	950-2205501
C216	1000UF 50V DJ3 -20+80% 5MM RADIAL CAP	855-1085950
C217	SMD 10NF 50V 10% CER X7R CAP 0805 (TRS)	950-1035621
C219	SMD 22PF 50V 5% CER COG CAP 0805 (TRS)	950-2205501
C220	10UF 16V 5MM RADIAL ELECT' CAP TR	155-1061751
C221	10UF 16V 5MM RADIAL ELECT' CAP TR	155-1061751
C222	10UF 16V 5MM RADIAL ELECT' CAP TR	155-1061751
C223	10UF 16V 5MM RADIAL ELECT' CAP TR	155-1061751
C224	10UF 16V 5MM RADIAL ELECT' CAP TR	155-1061751
C250	SMD 220NF 25V 20/80% CER Y5V CAP 0805 TR	950-2242951
C251	SMD 220NF 25V 20/80% CER Y5V CAP 0805 TR	950-2242951
C252	SMD 0.1UF 25V 20/80% CER Y5V CAP 0805 TR	950-1042951
C253	SMD 0.1UF 25V 20/80% CER Y5V CAP 0805 TR	950-1042951
C254	SMD 0.1UF 25V 20/80% CER Y5V CAP 0805 TR	950-1042951
C255	SMD 0.1UF 25V 20/80% CER Y5V CAP 0805 TR	950-1042951
C256	SMD 470PF 50V 10% CER X7R CAP 0805 (TRS)	950-4715621
C257	SMD 10NF 50V 10% CER X7R CAP 0805 (TRS)	950-1035621
C258	100UF 16V 5MM RADIAL ELECT' CAP TR	155-1071751
C259	SMD 47NF 50V 10% CER X7R CAP 0805 (TRS)	950-4735621
C260	470UF 35V DJ3 -20+80% 5MM RADIAL CAP	855-4773950
C261	SMD 47NF 50V 10% CER X7R CAP 0805 (TRS)	950-4735621
C262	10UF 25V 5MM RADIAL ELECT' CAP TR	155-1062751
C263	SMD 0.1UF 25V 20/80% CER Y5V CAP 0805 TR	950-1042951
C270	SMD 3.3NF 50V 5% CER X7R CAP 0805 (TRS)	950-3325521
C273	SMD 470PF 50V 10% CER X7R CAP 0805 (TRS)	950-4715621
C274	SMD 3.3NF 50V 5% CER X7R CAP 0805 (TRS)	950-3325521
C275	SMD 100PF 50V 5% CER COG CAP 0805 (TRS)	950-1015501
C287	SMD 33NF 25V 10% CER X7R CAP 0805 (TRS)	950-3332621
C288	1000UF 16V 5MM RAD ELEC' CAP (10X16)	155-1081750
C289	100UF 16V 5MM RADIAL ELECT' CAP TR	155-1071751
C291	SMD 220NF 25V 20/80% CER Y5V CAP 0805 TR	950-2242951
C293	10UF 16V 5MM RADIAL ELECT' CAP TR	155-1061751
C294	10UF 16V 5MM RADIAL ELECT' CAP TR	155-1061751
C295	CLASS X CAP-100NF 250V 20%	159-1048780
C500	SMD 220NF 25V 20/80% CER Y5V CAP 0805 TR	950-2242951
C501	100UF 16V 5MM RADIAL ELECT' CAP TR	155-1071751
C502	1000UF 16V 5MM RAD ELEC' CAP (10X16)	155-1081750
C503	10UF 16V 5MM RADIAL ELECT' CAP TR	155-1061751
C505	100UF 16V 5MM RADIAL ELECT' CAP TR	155-1071751
C506	SMD 0.1UF 25V 20/80% CER Y5V CAP 0805 TR	950-1042951
C507	1UF 16V 5MM RADIAL ELECT' CAP TR	155-1051751
C508	SMD 100PF 50V 5% CER COG CAP 0805 (TRS)	950-1015501
C509	1UF 16V 5MM RADIAL ELECT' CAP TR	155-1051751
C510	SMD 100PF 50V 5% CER COG CAP 0805 (TRS)	950-1015501
C512	SMD 0.1UF 25V 20/80% CER Y5V CAP 0805 TR	950-1042951
C514	SMD 56PF 50V 5% CER COG CAP 0805 (TRS)	950-5605501
C515	SMD 22PF 50V 5% CER COG CAP 0805 (TRS)	950-2205501
C516	SMD 220NF 25V 20/80% CER Y5V CAP 0805 TR	950-2242951
C517	00UF 16V 5MM RADIAL ELECT' CAP TR	155-1071751
C518	SMD 1NF 50V 5% CER COG CAP 0805 (TRS)	950-1025501
C519	22UF 16V 5MM RADIAL ELECT' CAP TR	155-2261751
C580	SMD 15PF 50V 5% CER COG CAP 0805 (TRS)	950-1505501
C581	10UF 16V 5MM RADIAL ELECT' CAP TR	155-1061751
C582	SMD 10PF 50V 5% CER CAP 0805 (TRS)	950-1005501
C583	SMD 15PF 50V 5% CER COG CAP 0805 (TRS)	950-1505501
C584	SMD 10PF 50V 5% CER CAP 0805 (TRS)	950-1005501
C586	22UF 16V 5MM RADIAL ELECT' CAP TR	155-2261751
C587	1UF 50V 5MM BOX POLYESTER CAP TR	152-1055651
C588	SMD 10NF 50V 10% CER X7R CAP 0805 (TRS)	950-1035621
C589	10UF 35V 5MM RADIAL ELECT' CAP TR	155-1063751
C590	10UF 16V 5MM RADIAL ELECT' CAP TR	155-1061751
C591	1UF 16V 5MM RADIAL ELECT' CAP TR	155-1051751
C592	SMD 33PF 50V 5% CER COG CAP 0805 (TRS)	950-3305501
C593	10UF 16V 5MM RADIAL ELECT' CAP TR	155-1061751
C594	10UF 16V 5MM RADIAL ELECT' CAP TR	155-1061751
C595	SMD 220NF 25V 20/80% CER Y5V CAP 0805 TR	950-2242951
C596	SMD 220NF 25V 20/80% CER Y5V CAP 0805 TR	950-2242951
C597	47UF 16V 5MM RADIAL ELECT' CAP TR	155-4761751
C598	47UF 16V 5MM RADIAL ELECT' CAP TR	155-4761751
C599	SMD 220NF 25V 20/80% CER Y5V CAP 0805 TR	950-2242951
C600	SMD 10NF 50V 10% CER X7R CAP 0805 (TRS)	950-1035621
C601	SMD 330NF 25V 20/80% CER Y5V CAP 0805 TR	950-3342951
C602	SMD 0.1UF 25V 20/80% CER Y5V CAP 0805 TR	950-1042951
C603	SMD 10PF 50V 5% CER CAP 0805 (TRS)	950-1005501
C604	10UF 16V 5MM RADIAL ELECT' CAP TR	155-1061751
C605	SMD 0.1UF 25V 20/80% CER Y5V CAP 0805 TR	950-1042951

SPARES - ELECTRICAL PARTS LISTS FOR MAIN BOARD (cont.)

C606	CER CAP-330PF 500V 10% 5MM (DE50-6) TR	159-3319651
C607	SMD 0.1UF 25V 20/80% CER Y5V CAP 0805 TR	950-1042951
C608	100UF 16V 5MM RADIAL ELECT' CAP TR	155-1071751
C609	22UF 16V 5MM RADIAL ELECT' CAP TR	155-2261751
C610	470UF 16V 5MM RADIAL ELECT' CAP TR	155-4771751
C611	SMD 270PF 50V 5% CER.CAP 0805 (TRS)	950-2715501
C612	SMD 270PF 50V 5% CER.CAP 0805 (TRS)	950-2715501
C613	SMD 18PF 50V 2% CER CAP 0805 (TRS)	950-1805201
C614	SMD 39PF 50V 5% CER COG CAP 0805 (TRS)	950-3905501
C615	SMD 270PF 50V 5% CER.CAP 0805 (TRS)	950-2715501
C616	SMD 220NF 25V 20/80% CER Y5V CAP 0805 TR	950-2242951
C617	SMD 0.1UF 25V 20/80% CER Y5V CAP 0805 TR	950-1042951

Diodes

D1	DIODE-1N4007 TR	120-0400701
D2	DIODE-1N4007 TR	120-0400701
D3	DIODE-1N4007 TR	120-0400701
D4	DIODE-1N4007 TR	120-0400701
D5	SMD DIODE-BAS16/DAN212KT146 SOT-23	912-0001651
D6	DIODE-BYV96D (PHILIPS) TR	120-0009611
D8	SIGNAL DIODE-1N4148 75MA 75V TR	120-0414801
D9	ZENER REFERENCE TL431 CLPRA TO92 TR	125-4310001
D10	DIODE - EGP30B TR	120-1003001
D11	DIODE-SB350 50V 3A SCHOTTKY	120-0035001
D12	DIODE - EGP30B TR	120-1003001
D13	DIODE - EGP30B TR	120-1003001
D14	SMD DIODE-BAS16/DAN212KT146 SOT-23	912-0001651
D15	DIODE-1N4007 TR	120-0400701
D17	SMD DIODE-BAS16/DAN212KT146 SOT-23	912-0001651
D18	27V 5% 400MW ZENER DIODE TR	125-0270501
D21	4V7 5% 400MW ZENER DIODE TR	125-0047501
D22	DIODE-1N4007 TR	120-0400701
D35	SMD DIODE-BAS19/ISS250 (TE85L) SOT-23 TR	912-0001951
D36	SMD DIODE-BB515 MINI PLAST (TRS)	912-0051501
D37	SMD DIODE-BB619 MINI PLAST (TRS)	912-0061901
D38	8V2 2% 400MW ZENER DIODE TR	125-0082201
D39	SMD DIODE-BAS16/DAN212KT146 SOT-23	912-0001651
D40	SMD DIODE-BAS19/ISS250 (TE85L) SOT-23 TR	912-0001951
D41	SMD DIODE-BAS16/DAN212KT146 SOT-23	912-0001651
D42	SMD DIODE-BAS16/DAN212KT146 SOT-23	912-0001651
D44	9V1 5% 400MW ZENER DIODE TR	125-0091501
D48	SMD DIODE-BAS16/DAN212KT146 SOT-23	912-0001651
D49	SMD DIODE-BAS16/DAN212KT146 SOT-23	912-0001651
D50	SMD DIODE-BAS16/DAN212KT146 SOT-23	912-0001651
D51	SMD DIODE-BAS16/DAN212KT146 SOT-23	912-0001651
D52	SMD DIODE-BAS16/DAN212KT146 SOT-23	912-0001651
D53	SMD DIODE-BAS16/DAN212KT146 SOT-23	912-0001651
D54	RECT DIODE 300V (FES8FT)	120-0008001
D55	SMD DIODE-BAS16/DAN212KT146 SOT-23	912-0001651
D56	DIODE - EGP30B TR	120-1003001
D57	SMD DIODE-BAS16/DAN212KT146 SOT-23	912-0001651
D62	8V2 2% 400MW ZENER DIODE TR	125-0082201
D63	SMD DIODE-BAS16/DAN212KT146 SOT-23	912-0001651
D67	5V6 5% 400MW ZENER DIODE TR	125-0056501
D68	SMD DIODE-BAS16/DAN212KT146 SOT-23	912-0001651
D69	SMD DIODE-BAS16/DAN212KT146 SOT-23	912-0001651
D71	SMD DIODE-BAS16/DAN212KT146 SOT-23	912-0001651
D72	DIODE-BYV96D (PHILIPS) TR	120-0009611

Inductors

L1	INDUCTOR-1A 100UH (TDK TSL1110-101K1RO)	131-1000500
L3	INDUCTOR-1A 100UH (TDK TSL1110-101K1RO)	131-1000500
L5	AXIAL INDUCTOR-1UH 5% TR	130-0010501
L6	200NH-COIL(GOLD) AIR WOUND (PEDOKA)	134-0200080
L7	200NH-COIL(GOLD) AIR WOUND (PEDOKA)	134-0200080
L8	BALUN-BC0403RID-B (PEDOKA)	133-0040300
L9	18NH-COIL (GOLD) AIR WOUND (PEDOKA)	134-0018080
L10	18NH-COIL (GOLD) AIR WOUND (PEDOKA)	134-0018080
L11	15NH-COIL(RED)AIR WOUND(PEDOKA) (A-26MM)	134-0015091
L12	SOUND COIL 4.7UH +-3% SUMIDA HKS-999-035	133-0047051
L13	2U2H 5% AXIAL INDUCTOR TR	130-0022501
L15	15UH 5% AXIAL INDUCTOR TR	130-0150501
L16	15UH 5% AXIAL INDUCTOR TR	130-0150501
L17	AXIAL INDUCTOR-22UH 10% TR	130-0220601
L18	AXIAL INDUCTOR-3U3H 10% TR	130-0033601
L19	AXIAL INDUCTOR-33UH 5% TR	130-0330501
L20	15UH 5% AXIAL INDUCTOR TR	130-0150501
L21	AXIAL INDUCTOR-18UH 5% 0.5MM TR	130-0180501
L22	AXIAL INDUCTOR-18UH 10% DC RES <0.8R TR	130-0180611
L23	TINNED COPPER WIRE LINKS 0.61MM DIA-PMF	999P1099901
L25	AXIAL IND -12UH 5% SRF 19MHZ MIN TR	130-0120501
L27	TINNED COPPER WIRE LINKS 0.61MM DIA-PMF	999P1099901
L28	AXIAL INDUCTOR-82UH 5% TR	130-0820501
L31	AXIAL INDUCTOR-18UH 10% DC RES <0.8R TR	130-0180611
L35	200NH-COIL(GOLD) AIR WOUND (PEDOKA)	134-0200080
L36	200NH-COIL(GOLD) AIR WOUND (PEDOKA)	134-0200080
L39	AXIAL INDUCTOR-18UH 10% DC RES <0.8R TR	130-0180611
L40	AXIAL INDUCTOR-18UH 10% DC RES <0.8R TR	130-0180611
L41	AXIAL INDUCTOR-18UH 10% DC RES <0.8R TR	130-0180611
L42	AXIAL INDUCTOR-18UH 10% DC RES <0.8R TR	130-0180611
L43	AXIAL INDUCTOR-18UH 10% DC RES <0.8R TR	130-0180611
L44	AXIAL INDUCTOR-18UH 10% DC RES <0.8R TR	130-0180611
L45	TINNED COPPER WIRE LINKS 0.61MM DIA-PMF	999P1099901
L46	AXIAL INDUCTOR-100UH 10% DC RES -1.8R TR	130-1000611
L47	AXIAL INDUCTOR-18UH 10% DC RES <0.8R TR	130-0180611
L48	AXIAL INDUCTOR-18UH 10% DC RES <0.8R TR	130-0180611
L49	AXIAL INDUCTOR-100UH 10% DC RES -1.8R TR	130-1000611
L50	AXIAL INDUCTOR-82UH 5% TR	130-0820501
L51	TINNED COPPER WIRE LINKS 0.61MM DIA-PMF	999P1099901
L52	RAD FERR BEAD(PEDOKA BL02RN2-R62T2) TR	133-0226201
L53	AXIAL IND -12UH 5% SRF 19MHZ MIN TR	130-0120501

Links

J1 to J4 and LK2 to LK320 are all:

TINNED COPPER WIRE LINKS 0.61MM DIA-PMF 999P1099901

Note: J2 and J3 are cut after factory testing

Connectors

Note: for plugs, see "unique" parts list at end of manual

SK1	*A* LEONHARDY 07-78.2300 MAINS INPUT SKT	875-0778231
SK2	SCART SOCKET-JR21A3 DOUBLE DECKER	163-4202111
SK3	SCART SOCKET-JR21A3 DOUBLE DECKER	163-4202111
SK4	PHONO SOCKET-5 WAY HORIZONTAL MOUNT	165-2000510

Transistors

Q1	TRANSISTOR-2SK1643 SI N-CHANNEL MOS TYPE	110-0164300
Q2	SMD TRANSISTOR-BC856B SOT-23	911-1085651
Q3	SMD TRANSISTOR-BC846B SOT-23	911-1084651
Q4	TRANSISTOR-TIP31	110-0003101
Q5	SMD TRANSISTOR-BC846B SOT-23	911-1084651
Q6	SMD TRANSISTOR-BC846B SOT-23	911-1084651
Q7	SMD TRANSISTOR-BC846B SOT-23	911-1084651
Q9	SMD TRANSISTOR-BC846B SOT-23	911-1084651
Q11	SMD TRANSISTOR-BC846B SOT-23	911-1084651
Q12	SMD TRANSISTOR-BC846B SOT-23	911-1084651
Q13	SMD TRANSISTOR-BC846B SOT-23	911-1084651
Q14	SMD TRANSISTOR-BC856B SOT-23	911-1085651
Q15	SMD TRANSISTOR-BC846B SOT-23	911-1084651
Q16	SMD TRANSISTOR-BC856B SOT-23	911-1085651
Q17	SMD TRANSISTOR-BC846B SOT-23	911-1084651
Q29	SMD TRANSISTOR-BC846B SOT-23	911-1084651
Q30	SMD TRANSISTOR-BFR193 SIEMENS SOT-23	911-0019351

SPARES - ELECTRICAL PARTS LISTS FOR MAIN BOARD (cont.)

Q31	SMD TRANSISTOR-BFR193 SIEMENS SOT-23	911-0019351
Q32	SMD TRANSISTOR-BC846B SOT-23	911-1084651
Q33	SMD TRANSISTOR-BC846B SOT-23	911-1084651
Q35	SMD TRANSISTOR-BC846B SOT-23	911-1084651
Q36	SMD TRANSISTOR-ZVN3306F SOT-23	911-0330651
Q37	SMD TRANSISTOR-BC846B SOT-23	911-1084651
Q38	SMD TRANSISTOR-BC846B SOT-23	911-1084651
Q40	SMD TRANSISTOR-BC846B SOT-23	911-1084651
Q41	SMD TRANSISTOR-BC856B SOT-23	911-1085651
Q42	SMD TRANSISTOR-BC846B SOT-23	911-1084651
Q43	TRANSISTOR-FXT749 (ZETEX) TR	110-0074911
Q44	TRANSISTOR-FXT749 (ZETEX) TR	110-0074911
Q45	SMD TRANSISTOR-BC846B SOT-23	911-1084651
Q46	SMD TRANSISTOR-BC846B SOT-23	911-1084651
Q47	SMD TRANSISTOR-BC856B SOT-23	911-1085651
Q48	SMD TRANSISTOR-BC856B SOT-23	911-1085651
Q49	SMD TRANSISTOR-BC846B SOT-23	911-1084651
Q50	SMD TRANSISTOR-BC846B SOT-23	911-1084651
Q51	SMD TRANSISTOR-BC846B SOT-23	911-1084651
Q52	SMD TRANSISTOR-ZVN3306F SOT-23	911-0330651
Q53	SMD TRANSISTOR-FMMT2369A SOT-23	911-0236951
Q54	SMD TRANSISTOR-BC846B SOT-23	911-1084651
Q55	SMD TRANSISTOR-BC856B SOT-23	911-1085651
Q56	SMD TRANSISTOR-BC846B SOT-23	911-1084651
Q57	SMD TRANSISTOR-BC846B SOT-23	911-1084651
Q58	SMD TRANSISTOR-BC856B SOT-23	911-1085651
Q59	SMD TRANSISTOR-BC856B SOT-23	911-1085651
Q61	SMD TRANSISTOR-BC846B SOT-23	911-1084651
Q62	SMD TRANSISTOR-BC846B SOT-23	911-1084651
Q63	SMD TRANSISTOR-BC846B SOT-23	911-1084651
Q64	SMD TRANSISTOR-BC856B SOT-23	911-1085651
Q65	SMD TRANSISTOR-FMMT2369A SOT-23	911-0236951
Q72	SMD TRANSISTOR-BC846B SOT-23	911-1084651
Q73	TRANSISTOR-FXT749 (ZETEX) TR	110-0074911
Q74	SMD TRANSISTOR-BC846B SOT-23	911-1084651
Q75	SMD TRANSISTOR-BC846B SOT-23	911-1084651
Q76	SMD TRANSISTOR-BC846B SOT-23	911-1084651
Q77	SMD TRANSISTOR-BC846B SOT-23	911-1084651
Q78	TRANSISTOR-ZVN3306A FET TO-92 PACKAGE	110-0330601
Q98	SMD TRANSISTOR-BC856B SOT-23	911-1085651
Q99	SMD TRANSISTOR-BC846B SOT-23	911-1084651
Q100	SMD TRANSISTOR-BC856B SOT-23	911-1085651
Q101	SMD TRANSISTOR-BC856B SOT-23	911-1085651
Q102	SMD TRANSISTOR-BC846B SOT-23	911-1084651
Q103	SMD TRANSISTOR-FMMT2369A SOT-23	911-0236951
Q104	SMD TRANSISTOR-BFR193 SIEMENS SOT-23	911-0019351
Q105	SMD TRANSISTOR-BC856B SOT-23	911-1085651
Q107	SMD TRANSISTOR-BC846B SOT-23	911-1084651
Q109	SMD TRANSISTOR-BC846B SOT-23	911-1084651
Q110	SMD TRANSISTOR-BC846B SOT-23	911-1084651
Q111	SMD TRANSISTOR-BC846B SOT-23	911-1084651
Q112	SMD TRANSISTOR-BC846B SOT-23	911-1084651
Q113	SMD TRANSISTOR-BC846B SOT-23	911-1084651
Q114	TRANSISTOR-FXT749 (ZETEX) TR	110-0074911
Q115	SMD TRANSISTOR-BC846B SOT-23	911-1084651
Q116	SMD TRANSISTOR-BC846B SOT-23	911-1084651

Resistors

R1	10R 6W 5% CERAMIC CASED PLUGGABLE RES	144-1009500
R2	SMD 100K 0.1W 5% RES 0805 (TRS)	940-1040501
R3	SMD 22K 0.1W 5% RES 0805 (TRS)	940-2230501
R4	SMD 1K 0.1W 5% RES 0805 (TRS)	940-1020501
R5	47K 3W 5% 17.5MM FLAME RETARDANT MOR-3W	148-4738501
R6	SMD 1M 0.1W 5% RES 0805 (TRS)	940-1050501
R7	1K 5W 10% AX/PLUG CER CASE RES	145-1029600
R8	27R 0.25W 5% CARBON FILM RES TR	140-2702501
R9	0R75 0.5W 5% NON-FLAMMABLE RES (TR)	148-0075551
R10	SMD 1K 0.1W 5% RES 0805 (TRS)	940-1020501
R11	SMD 470R 0.1W 5% RES 0805 (TRS)	940-4710501
R12	SMD 1K 0.1W 1% RES 0805 (TRS)	940-1020101
R13	SMD 1K2 0.1W 1% RES 0805 (TRS)	940-1220101
R14	SMD 150R 0.1W 5% RES 0805 (TRS)	940-1510501
R15	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R16	SMD 470R 0.1W 5% RES 0805 (TRS)	940-4710501
R17	SMD 4K7 0.1W 5% RES 0805 (TRS)	940-4720501
R18	SMD 33K 0.1W 5% RES 0805 (TRS)	940-3330501
R19	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R20	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R22	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R23	SMD 22K 0.1W 5% RES 0805 (TRS)	940-2230501
R24	SMD 4K7 0.1W 5% RES 0805 (TRS)	940-4720501
R25	SMD 4K7 0.1W 5% RES 0805 (TRS)	940-4720501
R26	1R5 0.25W 5% CARBON FILM RES (TR)	140-0152501
R27	SMD 1K 0.1W 5% RES 0805 (TRS)	940-1020501
R28	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R29	SMD 4K7 0.1W 5% RES 0805 (TRS)	940-4720501
R30	SMD 4K7 0.1W 5% RES 0805 (TRS)	940-4720501
R31	SMD 11K 0.1W 1% RES 0805 (TRS	940-1130101
R32	1K 0.25W 1% METAL FILM RES TR	141-1022101
R33	1K 0.25W 1% METAL FILM RES TR	141-1022101
R34	SMD 2K7 0.1W 1% RES 0805 (TRS)	940-2720101
R35	SMD 4K7 0.1W 5% RES 0805 (TRS)	940-4720501
R36	SMD 4K7 0.1W 5% RES 0805 (TRS)	940-4720501
R37	SMD 5K6 0.1W 1% RES 0805 (TRS)	940-5620101
R38	SMD 180R 0.1W 5% RES 0805 (TRS)	940-1810501
R39	SMD 4K7 0.1W 5% RES 0805 (TRS)	940-4720501
R40 ⚠	*A* 10M 0.5W VR37 METAL FILM RES TR	142-1065511
R44	SMD 1K 0.1W 5% RES 0805 (TRS)	940-1020501
R45	SMD 1K 0.1W 5% RES 0805 (TRS)	940-1020501
R46	SMD 11K 0.1W 5% RES 0805 (TRS)	940-1130501
R47	SMD 11K 0.1W 5% RES 0805 (TRS)	940-1130501
R48	SMD 2K2 0.1W 5% RES 0805 (TRS)	940-2220501
R49	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R50	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R51	SMD 4K7 0.1W 5% RES 0805 (TRS)	940-4720501
R52	SMD 5K1 0.1W 5% RES 0805 (TRS)	940-5120501
R53	SMD 1K 0.1W 5% RES 0805 (TRS)	940-1020501
R55	SMD 1K 0.1W 5% RES 0805 (TRS)	940-1020501
R60	SMD 10R 0.1W 5% RES 0805 (TRS)	940-1000501
R61	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R62	SMD 620R 0.1W 5% RES 0805 (TRS)	940-6210501
R63	SMD 390R 0.1W 5% RES 0805 (TRS)	940-3910501
R64	SMD 120R 0.1W 5% RES 0805 (TRS)	940-1210501
R65	SMD 2K2 0.1W 5% RES 0805 (TRS)	940-2220501
R66	SMD 1K 0.1W 5% RES 0805 (TRS)	940-1020501
R67	SMD 220R 0.1W 5% RES 0805 (TRS)	940-2210501
R68	SMD 330R 0.1W 5% RES 0805 (TRS)	940-3310501
R69	SMD 470R 0.1W 5% RES 0805 (TRS)	940-4710501
R70	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R71	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R72	SMD 100R 0.1W 5% RES 0805 (TRS)	940-1010501
R73	SMD 4K7 0.1W 5% RES 0805 (TRS)	940-4720501
R74	SMD 33K 0.1W 5% RES 0805 (TRS)	940-3330501
R75	SMD 1K5 0.1W 5% RES 0805 (TRS)	940-1520501
R76	SMD 56R 0.1W 5% RES 0805 (TRS)	940-5600501
R77	SMD 56R 0.1W 5% RES 0805 (TRS)	940-5600501
R78	SMD 56R 0.1W 5% RES 0805 (TRS)	940-5600501
R79	SMD 56R 0.1W 5% RES 0805 (TRS)	940-5600501
R80	SMD 56R 0.1W 5% RES 0805 (TRS)	940-5600501
R81	SMD 56R 0.1W 5% RES 0805 (TRS)	940-5600501
R82	SMD 56R 0.1W 5% RES 0805 (TRS)	940-5600501
R83	SMD 56R 0.1W 5% RES 0805 (TRS)	940-5600501

SPARES - ELECTRICAL PARTS LISTS FOR MAIN BOARD (cont.)

R85	SMD 4K7 0.1W 5% RES 0805 (TRS)	940-4720501
R86	SMD 4K7 0.1W 5% RES 0805 (TRS)	940-4720501
R87	SMD 6K8 0.1W 5% RES 0805 (TRS)	940-6820501
R88	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R89	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R90	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R91	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R92	SMD 1M 0.1W 5% RES 0805 (TRS)	940-1050501
R93	SMD 100R 0.1W 5% RES 0805 (TRS)	940-1010501
R94	SMD 100R 0.1W 5% RES 0805 (TRS)	940-1010501
R95	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R96	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R97	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R98	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R99	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R100	SMD 100R 0.1W 5% RES 0805 (TRS)	940-1010501
R101	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R102	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R103	SMD 4K7 0.1W 5% RES 0805 (TRS)	940-4720501
R104	SMD 22K 0.1W 5% RES 0805 (TRS)	940-2230501
R105	SMD 220K 0.1W 5% RES 0805 (TRS)	940-2240501
R106	SMD 47K 0.1W 5% RES 0805 (TRS)	940-4730501
R108	SMD 220K 0.1W 5% RES 0805 (TRS)	940-2240501
R109	SMD 220K 0.1W 5% RES 0805 (TRS)	940-2240501
R110	100K 2W 5% METAL FILM RES TR	142-1046511
R111	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R112	SMD 100K 0.1W 5% RES 0805 (TRS)	940-1040501
R113	SMD 1K8 0.1W 5% RES 0805 (TRS)	940-1820501
R114	SMD 1K8 0.1W 5% RES 0805 (TRS)	940-1820501
R115	1R0 0.25W 5% CARBON FILM RES	140-0102501
R150	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R151	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R156	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R157	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R158	SMD 470R 0.1W 5% RES 0805 (TRS)	940-4710501
R159	SMD 470R 0.1W 5% RES 0805 (TRS)	940-4710501
R160	SMD 1K2 0.1W 5% RES 0805 (TRS)	940-1220501
R161	SMD 220R 0.1W 5% RES 0805 (TRS)	940-2210501
R162	SMD 12R 0.1W 5% RES 0805 (TRS)	940-1200501
R163	SMD 12R 0.1W 5% RES 0805 (TRS)	940-1200501
R164	SMD 220R 0.1W 5% RES 0805 (TRS)	940-2210501
R165	SMD 12R 0.1W 5% RES 0805 (TRS)	940-1200501
R166	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R167	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R168	SMD 120R 0.1W 5% ES 0805 (TRS)	940-1210501
R169	SMD 560R 0.1W 5% RES 0805 (TRS)	940-5610501
R170	SMD 330R 0.1W 5% RES 0805 (TRS)	940-3310501
R171	SMD 330R 0.1W 5% RES 0805 (TRS)	940-3310501
R172	SMD 150R 0.1W 5% RES 0805 (TRS)	940-1510501
R173	SMD 33R 0.1W 5% RES 0805 (TRS)	940-3300501
R174	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R176	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R177	SMD 22R 0.1W 5% RES 0805 (TRS)	940-2200501
R178	SMD 12R 0.1W 5% RES 0805 (TRS)	940-1200501
R179	SMD 220R 0.1W 5% RES 0805 (TRS)	940-2210501
R180	SMD 12R 0.1W 5% RES 0805 (TRS)	940-1200501
R181	SMD 22K 0.1W 5% RES 0805 (TRS)	940-2230501
R182	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R183	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R184	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R186	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R187	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R188	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R189	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R190	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R191	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R192	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R194	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R195	SMD 22K 0.1W 5% RES 0805 (TRS)	940-2230501
R196	SMD 75R 0.1W 5% RES 0805 (TRS)	940-7500501
R197	SMD 8K2 0.1W 5% RES 0805 (TRS)	940-8220501
R198	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R199	SMD 1K 0.1W 5% RES 0805 (TRS)	940-1020501
R201	SMD 2K 0.1W 5% RES 0805 (TRS)	940-2020501
R203	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R204	SMD 2K 0.1W 5% RES 0805 (TRS)	940-2020501
R205	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R206	SMD 1K2 0.1W 1% RES 0805 (TRS)	940-1220101
R207	SMD 3K3 0.1W 5% RES 0805 (TRS)	940-3320501
R208	SMD 1K2 0.1W 1% RES 0805 (TRS)	940-1220101
R210	33R 0.5W 5% CARBON FILM RES (TR)	140-3305501
R211	SMD 22K 0.1W 5% RES 0805 (TRS)	940-2230501
R212	SMD 22K 0.1W 5% RES 0805 (TRS)	940-2230501
R215	SMD 4K7 0.1W 5% RES 0805 (TRS)	940-4720501
R216	SMD 12K 0.1W 5% RES 0805 (TRS)	940-1230501
R217	SMD 75R 0.1W 5% RES 0805 (TRS)	940-7500501
R220	SMD 330R 0.1W 5% RES 0805 (TRS)	940-3310501
R222	SMD 4K7 0.1W 5% RES 0805 (TRS)	940-4720501
R223	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R224	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R227	SMD 75R 0.1W 5% RES 0805 (TRS)	940-7500501
R228	SMD 47R 0.1W 5% RES 0805 (TRS)	940-4700501
R229	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R230	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R233	SMD 1K 0.1W 5% RES 0805 (TRS)	940-1020501
R236	SMD 220K 0.1W 5% RES 0805 (TRS)	940-2240501
R237	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R238	SMD 22K 0.1W 5% RES 0805 (TRS)	940-2230501
R239	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R240	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R243	SMD 10M 0.1W 5% RES 0805 (TR)	940-1060501
R244	SMD 10M 0.1W 5% RES 0805 (TR)	940-1060501
R245	SMD 4K7 0.1W 5% RES 0805 (TRS)	940-4720501
R246	SMD 4K7 0.1W 5% RES 0805 (TRS)	940-4720501
R247	SMD 75R 0.1W 5% RES 0805 (TRS)	940-7500501
R250	SMD 4K7 0.1W 5% RES 0805 (TRS)	940-4720501
R251	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R252	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R255	SMD 470R 0.1W 5% RES 0805 (TRS)	940-4710501
R256	SMD 220R 0.1W 5% RES 0805 (TRS)	940-2210501
R257	SMD 220R 0.1W 5% RES 0805 (TRS)	940-2210501
R258	SMD 1K 0.1W 5% RES 0805 (TRS)	940-1020501
R259	SMD 220R 0.1W 5% RES 0805 (TRS)	940-2210501
R260	SMD 4K7 0.1W 5% RES 0805 (TRS)	940-4720501
R261	SMD 4K7 0.1W 5% RES 0805 (TRS)	940-4720501
R262	SMD 12K 0.1W 5% RES 0805 (TRS)	940-1230501
R263	SMD 2K2 0.1W 5% RES 0805 (TRS)	940-2220501
R264	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R265	SMD 2K2 0.1W 5% RES 0805 (TRS)	940-2220501
R269	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R270	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R271	1K5 0.25W 5% CARBON FILM RES TR	140-1522501
R272	1K5 0.25W 5% CARBON FILM RES TR	140-1522501
R273	SMD 6K8 0.1W 5% RES 0805 (TRS)	940-6820501
R274	SMD 4K7 0.1W 5% RES 0805 (TRS)	940-4720501
R275	SMD 4K7 0.1W 5% RES 0805 (TRS)	940-4720501
R276	SMD 330R 0.1W 5% RES 0805 (TRS)	940-3310501
R277	SMD 3K3 0.1W 5% RES 0805 (TRS)	940-3320501
R278	SMD 1K 0.1W 5% RES 0805 (TRS)	940-1020501
R279	SMD 330R 0.1W 5% RES 0805 (TRS)	940-3310501
R280	SMD 3K3 0.1W 5% RES 0805 (TRS)	940-3320501
R281	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501

SPARES - ELECTRICAL PARTS LISTS FOR MAIN BOARD (cont.)

R282	SMD 15K 0.1W 5% RES 0805 (TRS)	940-1530501
R283	SMD 1K2 0.1W 5% RES 0805 (TRS)	940-1220501
R284	SMD 820R 0.1W 5% RES 0805 (TRS)	940-8210501
R285	SMD 680R 0.1W 5% RES 0805 (TRS)	940-6810501
R286	SMD 820R 0.1W 5% RES 0805 (TRS)	940-8210501
R287	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R288	SMD 15K 0.1W 5% RES 0805 (TRS)	940-1530501
R289	SMD 8K2 0.1W 5% RES 0805 (TRS)	940-8220501
R290	SMD 2K2 0.1W 5% RES 0805 (TRS)	940-2220501
R291	SMD 130R 0.1W 5% RES 0805 (TRS)	940-1310501
R292	SMD 270R 0.1W 5% RES 0805 (TRS)	940-2710501
R293	SMD 750R 0.1W 5% RES 0805 TR	940-7510501
R294	SMD 910R 0.1W 5% RES 0805 (TRS)	940-9110501
R295	SMD 4K7 0.1W 5% RES 0805 (TRS)	940-4720501
R296	SMD 750R 0.1W 5% RES 0805 TR	940-7510501
R297	SMD 2K2 0.1W 5% RES 0805 (TRS)	940-2220501
R298	SMD 330R 0.1W 5% RES 0805 (TRS)	940-3310501
R299	SMD 1K2 0.1W 5% RES 0805 (TRS)	940-1220501
R300	SMD 1K 0.1W 5% RES 0805 (TRS)	940-1020501
R301	SMD 1K 0.1W 5% RES 0805 (TRS)	940-1020501
R304	SMD 1K 0.1W 1% RES 0805 (TRS)	940-1020101
R305	SMD 1K 0.1W 1% RES 0805 (TRS)	940-1020101
R306	SMD 270R 0.1W 1% RES 0805 TR	940-2710101
R307	SMD 165R 0.1W 1% RES 0805 (TRS)	940-1650191
R308	SMD 1K1 0.1W 1% RES 0805 (TRS)	940-1120101
R309	SMD 1K 0.1W 5% RES 0805 (TRS)	940-1020501
R310	SMD 100K 0.1W 5% RES 0805 (TRS)	940-1040501
R311	SMD 2K2 0.1W 1% RES 0805 (TRS)	940-2220101
R312	SMD 51R 0.1W 5% RES 0805 (TRS)	940-5100501
R313	SMD 51R 0.1W 5% RES 0805 (TRS)	940-5100501
R314	SMD 2K 0.1W 5% RES 0805 (TRS)	940-2020501
R315	SMD 2K2 0.1W 5% RES 0805 (TRS)	940-2220501
R316	SMD 2K2 0.1W 5% RES 0805 (TRS)	940-2220501
R317	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R318	SMD 22K 0.1W 5% RES 0805 (TRS)	940-2230501
R319	SMD 470R 0.1W 5% RES 0805 (TRS)	940-4710501
R320	SMD 1K 0.1W 5% RES 0805 (TRS)	940-1020501
R321	SMD 220R 0.1W 5% RES 0805 (TRS)	940-2210501
R322	SMD 220R 0.1W 5% RES 0805 (TRS)	940-2210501
R323	SMD 100R 0.1W 5% RES 0805 (TRS)	940-1010501
R324	SMD 150R 0.1W 5% RES 0805 (TRS)	940-1510501
R325	SMD 680R 0.1W 5% RES 0805 (TRS)	940-6810501
R326	SMD 330R 0.1W 5% RES 0805 (TRS)	940-3310501
R327	SMD 1K 0.1W 5% RES 0805 (TRS)	940-1020501
R328	SMD 75R 0.1W 5% RES 0805 (TRS)	940-7500501
R329	SMD 150R 0.1W 5% RES 0805 (TRS)	940-1510501
R330	SMD 75R 0.1W 5% RES 0805 (TRS)	940-7500501
R331	SMD 1K 0.1W 5% RES 0805 (TRS)	940-1020501
R332	SMD 220R 0.1W 5% RES 0805 (TRS)	940-2210501
R333	SMD 270R 0.1W 5% RES 0805 (TRS)	940-2710501
R334	SMD 220R 0.1W 5% RES 0805 (TRS)	940-2210501
R335	SMD 270R 0.1W 5% RES 0805 (TRS)	940-2710501
R336	SMD 390R 0.1W 5% RES 0805 (TRS)	940-3910501
R337	SMD 1K2 0.1W 5% RES 0805 (TRS)	940-1220501
R339	SMD 560R 0.1W 5% RES 0805 (TRS)	940-5610501
R340	SMD 120R 0.1W 5% RES 0805 (TRS)	940-1210501
R342	SMD 330R 0.1W 5% RES 0805 (TRS)	940-3310501
R343	SMD 75R 0.1W 5% RES 0805 (TRS)	940-7500501
R345	SMD 100R 0.1W 5% RES 0805 (TRS)	940-1010501
R346	SMD 330R 0.1W 5% RES 0805 (TRS)	940-3310501
R347	SMD 100K 0.1W 5% RES 0805 (TRS)	940-1040501
R348	SMD 100R 0.1W 5% RES 0805 (TRS)	940-1010501
R349	SMD 560R 0.1W 5% RES 0805 (TRS)	940-5610501
R350	SMD 270K 0.1W 5% RES 0805 (TRS)	940-2740501
R351	SMD 3K9 0.1W 5% RES 0805 (TRS)	940-3920501
R352	SMD 2K7 0.1W 5% RES 0805 (TRS)	940-2720501
R353	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R354	SMD 5K6 0.1W 5% RES 0805 (TRS)	940-5620501
R355	SMD 3K3 0.1W 1% RES 0805 (TRS)	940-3320101
R356	SMD 2K7 0.1W 5% RES 0805 (TRS)	940-2720501
R357	SMD 470R 0.1W 5% RES 0805 (TRS)	940-4710501
R358	SMD 56K 0.1W 5% RES 0805 (TRS)	940-5630501
R359	SMD 33K 0.1W 5% RES 0805 (TRS)	940-3330501
R360	SMD 820R 0.1W 5% RES 0805 (TRS)	940-8210501
R361	SMD 1K 0.1W 5% RES 0805 (TRS)	940-1020501
R362	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R363	SMD 4K7 0.1W 5% RES 0805 (TRS)	940-4720501
R364	SMD 470R 0.1W 5% RES 0805 (TRS)	940-4710501
R365	2K7 0.25W 5% CARBON FILM RES TR	140-2722501
R367	47K 3W 5% 17.5MM FLAME RETARDANT MOR-3W	148-4738501
R368	SMD 22K 0.1W 5% RES 0805 (TRS)	940-2230501
R369	SMD 33K 0.1W 1% RES 0805 (TRS)	940-3330101
R379	SMD 4K7 0.1W 5% RES 0805 (TRS)	940-4720501
R380	SMD 4K7 0.1W 5% RES 0805 (TRS)	940-4720501
R382	SMD 4K7 0.1W 5% RES 0805 (TRS)	940-4720501
R383	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R385	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R396	SMD 100R 0.1W 5% RES 0805 (TRS)	940-1010501
R397	SMD 100R 0.1W 5% RES 0805 (TRS)	940-1010501
R398	SMD 100R 0.1W 5% RES 0805 (TRS)	940-1010501
R399	SMD 100R 0.1W 5% RES 0805 (TRS)	940-1010501
R400	SMD 100K 0.1W 5% RES 0805 (TRS)	940-1040501
R401	SMD 100K 0.1W 5% RES 0805 (TRS)	940-1040501
R402	SMD 75R 0.1W 5% RES 0805 (TRS)	940-7500501
R404	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R407	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R411	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R413	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R414	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R416	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R417	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R419	SMD 1K 0.1W 5% RES 0805 (TRS)	940-1020501
R420	SMD 560R 0.1W 5% RES 0805 (TRS)	940-5610501
R421	SMD 75R 0.1W 5% RES 0805 (TRS)	940-7500501
R422	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R424	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R425	SMD 1K 0.1W 5% RES 0805 (TRS)	940-1020501
R426	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R427	SMD 1K 0.1W 5% RES 0805 (TRS)	940-1020501
R428	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R430	SMD 1K 0.1W 5% RES 0805 (TRS)	940-1020501
R432	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R433	SMD 100R 0.1W 5% RES 0805 (TRS)	940-1010501
R434	SMD 100R 0.1W 5% RES 0805 (TRS)	940-1010501
R435	SMD 100R 0.1W 5% RES 0805 (TRS)	940-1010501
R436	SMD 100R 0.1W 5% RES 0805 (TRS)	940-1010501
R437	SMD 1K 0.1W 5% RES 0805 (TRS)	940-1020501
R440	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R442	SMD 1K 0.1W 5% RES 0805 (TRS)	940-1020501
R443	SMD 4K7 0.1W 5% RES 0805 (TRS)	940-4720501
R444	SMD 2K2 0.1W 5% RES 0805 (TRS)	940-2220501
R445	SMD 1K 0.1W 5% RES 0805 (TRS)	940-1020501
R446	SMD 4K7 0.1W 5% RES 0805 (TRS)	940-4720501
R506	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R512	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R515	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R518	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R519	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R520	100R 0.25W 5% CARBON FILM RES TR	140-1012501
R521	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R523	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R524	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501

SPARES - ELECTRICAL PARTS LISTS FOR MAIN BOARD (cont.)

R526	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R527	SMD 220NF 25V 20/80% CER Y5V CAP 0805 TR	950-2242951
R528	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R529	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R530	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R532	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R533	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R534	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R535	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R536	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R537	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R538	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R540	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R541	SMD 470R 0.1W 5% RES 0805 (TRS)	940-4710501
R542	SMD 470R 0.1W 5% RES 0805 (TRS)	940-4710501
R543	SMD 100R 0.1W 5% RES 0805 (TRS)	940-1010501
R544	SMD 100R 0.1W 5% RES 0805 (TRS)	940-1010501
R545	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R548	SMD 330R 0.1W 5% RES 0805 (TRS)	940-3310501
R554	SMD 4K7 0.1W 5% RES 0805 (TRS)	940-4720501
R555	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R556	SMD 4K7 0.1W 5% RES 0805 (TRS)	940-4720501
R559	SMD 75R 0.1W 5% RES 0805 (TRS)	940-7500501
R560	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R561	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R562	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R563	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R567	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R568	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R569	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R572	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R573	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R574	SMD 18K 0.1W 1% RES 0805 (TRS)	940-1830101
R575	SMD 12K 0.1W 5% RES 0805 (TRS)	940-1230501
R576	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R577	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R578	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R579	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R580	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R581	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R590	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R592	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R594	0R75 0.5W 5% NON-FLAMMABLE RES (TR)	148-0075551
R595	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R596	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R598	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R599	SMD 4K7 0.1W 5% RES 0805 (TRS)	940-4720501
R600	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R601	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R602	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R603	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R606	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R607	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R612	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R613	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R616	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R617	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R618	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R619	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R620	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R621	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R625	SMD 15K 0.1W 5% RES 0805 (TRS)	940-1530501
R626	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R627	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R629	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R631	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R632	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R633	SMD 47K 0.1W 5% RES 0805 (TRS)	940-4730501
R634	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R635	SMD 100R 0.1W 5% RES 0805 (TRS)	940-1010501
R636	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R639	SMD 100K 0.1W 5% RES 0805 (TRS)	940-1040501
R640	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R641	SMD 4K7 0.1W 5% RES 0805 (TRS)	940-4720501
R642	SMD 100K 0.1W 5% RES 0805 (TRS)	940-1040501
R643	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R644	SMD 4K7 0.1W 5% RES 0805 (TRS)	940-4720501
R645	220R 3W 5% CERAMIC CASED PLUGGABLE RES	144-2218500
R646	SMD 9K1 0.1W 5% RES 0805 (TRS)	940-9120501
R647	SMD 4K7 0.1W 5% RES 0805 (TRS)	940-4720501
R648	SMD 68R 0.1W 5% RES 0805 (TRS)	940-6800501
R649	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R650	SMD 68R 0.1W 5% RES 0805 (TRS)	940-6800501
R651	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R652	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R653	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R655	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R656	SMD 1K 0.1W 5% RES 0805 (TRS)	940-1020501
R657	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R658	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R659	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R660	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R661	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R662	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	40-0000501
R663	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R665	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R666	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R667	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R668	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R671	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R673	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R674	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R675	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R676	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R677	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R680	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R681	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R682	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R684	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R703	SMD 1K 0.1W 5% RES 0805 (TRS)	940-1020501
R704	SMD 680R 0.1W 5% RES 0805 (TRS)	940-6810501
R705	SMD 330R 0.1W 5% RES 0805 (TRS)	940-3310501
R706	SMD 1K5 0.1W 5% RES 0805 (TRS)	940-1520501
R707	SMD 3K3 0.1W 5% RES 0805 (TRS)	940-3320501
R708	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R709	SMD 4K7 0.1W 5% RES 0805 (TRS)	940-4720501
R710	0R75 0.5W 5% NON-FLAMMABLE RES (TR)	148-0075551
R711	0R75 0.5W 5% NON-FLAMMABLE RES (TR)	148-0075551
R712	SMD 470K 0.1W 5% RES 0805 (TRS)	940-4740501
R713	SMD 47R 0.1W 5% RES 0805 (TRS)	940-4700501
R714	SMD 22R 0.1W 5% RES 0805 (TRS)	940-2200501
R715	SMD 22R 0.1W 5% RES 0805 (TRS)	940-2200501
R716	SMD 220R 0.1W 5% RES 0805 (TRS)	940-2210501
R720	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R721	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R722	SMD 4K7 0.1W 5% RES 0805 (TRS)	940-4720501
R723	SMD 4K7 0.1W 5% RES 0805 (TRS)	940-4720501
R724	SMD 4K7 0.1W 5% RES 0805 (TRS)	940-4720501
R725	SMD 4K7 0.1W 5% RES 0805 (TRS)	940-4720501
R727	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R728	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R729	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501

SPARES - ELECTRICAL PARTS LISTS FOR MAIN BOARD (cont.)

R730	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R731	SMD 330R 0.1W 5% RES 0805 (TRS)	940-3310501
R732	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R734	390R 0.25W 5% CARBON FILM RES TR	140-3912501
R735	SMD 75R 0.1W 5% RES 0805 (TRS)	940-7500501
R738	SMD 1K 0.1W 5% RES 0805 (TRS)	940-1020501
R740	SMD 4K7 0.1W 5% RES 0805 (TRS)	940-4720501
R741	SMD 820R 0.1W 5% RES 0805 (TRS)	940-8210501
R742	SMD 1K 0.1W 5% RES 0805 (TRS)	940-1020501
R743	SMD 12K 0.1W 5% RES 0805 (TRS)	940-1230501
R745	4K7 0.25W 5% CARBON FILM RES TR	140-4722501
R746	SMD 5K6 0.1W 5% RES 0805 (TRS)	940-5620501
R747	SMD 100K 0.1W 5% RES 0805 (TRS)	940-1040501
R748	SMD 2K2 0.1W 5% RES 0805 (TRS)	940-2220501
R749	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R751	SMD 22R 0.1W 5% RES 0805 (TRS)	940-2200501
R752	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R754	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R755	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R758	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R759	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R760	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R761	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R763	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R764	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R765	SMD 4K7 0.1W 5% RES 0805 (TRS)	940-4720501
R766	SMD 220R 0.1W 5% RES 0805 (TRS)	940-2210501
R767	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R768	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R769	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R771	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R772	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R773	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R774	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R775	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R776	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R777	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R778	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R780	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R781	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R782	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R784	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R785	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R787	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R788	SMD 22R 0.1W 5% RES 0805 (TRS)	940-2200501
R789	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R790	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R791	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R792	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R793	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R794	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R795	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R797	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R798	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R799	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R802	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R803	SMD 470R 0.1W 5% RES 0805 (TRS)	940-4710501
R804	SMD 10R 0.1W 5% RES 0805 (TRS)	940-1000501
R805	SMD 180R 0.1W 5% RES 0805 (TRS)	940-1810501
R806	SMD 180R 0.1W 5% RES 0805 (TRS)	940-1810501
R807	SMD 180R 0.1W 5% RES 0805 (TRS)	940-1810501
R809	SMD 1K 0.1W 5% RES 0805 (TRS)	940-1020501
R810	SMD 18K 0.1W 1% RES 0805 (TRS)	940-1830101
R811	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R812	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R813	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R818	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R819	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R820	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R821	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R822	SMD 47K 0.1W 5% RES 0805 (TRS)	940-4730501

Integrated Circuits

U1	SWITCH MODE IC MC3842	109-0384200
U2 ⚠	*A*OPTO COUPLER 6 PIN IC PC111LY	108-0011101
U3	LM358/KA358 DUAL OP AMP LOW POWER	100-0035800
U5	(A VIDEOCRYPT COMPONENT)	109-0011001
U6	(A VIDEOCRYPT COMPONENT)	109-0011401
U7	M50555 001P DISPLAY CONT (MISUBISHI)	109-0505551
U8	(A VIDEOCRYPT COMPONENT)	109-0011201
U9	(A VIDEOCRYPT COMPONENT)	109-0011501
U15	SL5066 VIDEO MODULATOR (PLESSEY)	109-0506601
U16	SP4633 SO PRESCALER (PLESSEY)	109-0463301
U17	74HC4053 TRIPLE 2-CHANNEL MULTIPLEXER	102-1405300
U18	SOUND PROCESSOR MSP3400 "64 PIN DIL"	109-0340000
U19	TL084 QUAD BI-FET OP AMP LOW NOISE	100-0008400
U20	74HC4053 TRIPLE 2-CHANNEL MULTIPLEXER	102-1405300
U21	HEF 4052 DUAL 4-CHANNEL MULTIPLEXER	106-0405200
U25	CD4094BCN 8 BIT SHIFT AND STORE REGISTER	106-0409400
U26	NICKY ASIC 3	109-0960103
U27	24C32 32K EE	104-0243200
U29	(A VIDEOCRYPT COMPONENT)	109-0011101
U30	74HC4053 TRIPLE 2-CHANNEL MULTIPLEXER	102-1405300
U31	74LS74 DUAL D TYPE EDGE TRIG. FLIP/FLOP	101-0007400
U32	74HC4053 TRIPLE 2-CHANNEL MULTIPLEXER	102-1405300

Miscellaneous Components

FIT TO FS1 and FS2:		
	FUSECLIP-PFC5000-0202 (SMK)	201-7500001
FIT TO U22:		
	SOCKET 20 WAY TOP ENTRY (HARWIN)	161-2002001
FS1 ⚠	*A* FUSE F1AL 20 X 5MM GLASS FAST BLOWN	201-2521000
FS2 ⚠	*A* FUSE F2AL 20 X 5MM GLASS FAST BLOW	201-2521100
Heatsinks HS1, HS2 and HS3 each comprise the following 3 parts:		
	HEATSINK-TV216 POWERFIN (TO220)	202-0021600
	KEROTHERM PAD TYPE 86/37(13.5X37X0.2)	208-0863701
	SPRING CLAMP-7701 TO220 FOR TV216 H/SINK	249-0770100
MOD 1	MODULATOR SCREENING CAN-FRAME REV I	315-0235102
REG1	V/REGULATOR-LM7812 +12V 1.5A TO-220	105-0781200
T1	MAINS FILTER-UF2327S4-463V0R6-10 TDK	232-2327400
T3 ⚠	*A* TRANSFORMER-SWITCH MODE FOR MSS1000	237-1000001
TST1	TEST PIN-VIDEOCRYPT	161-1000100
X1	XTAL 28MHZ HC18U 50/100/-20/30PF PAR 3RD	170-0280000
X2	XTAL 18.432MHZ HC18U 40/40/10/ 10PF PAR	170-0184320
X4	XTAL 17.734MHZ HC49U 20/30/10 10PF PAR	170-0177341
X5	RESONATOR-503KHZ TYPE CSB503F21	171-0005030
X6	CERAMIC TRAP TPS 4.43MJ	176-0044301

SPARES - ELECTRICAL PARTS LIST FOR SOUND BOARD

Capacitors

C1	47UF 16V 5MM RADIAL ELECT' CAP TR	155-4761751
C2	2200UF 16V 7.5MM RADIAL ELECT' CAP	155-2281770
C3	SMD 33PF 50V 5% CER COG CAP 0805 (TRS)	950-3305501
C4	SMD 33PF 50V 5% CER COG CAP 0805 (TRS)	950-3305501
C5	SMD 0.1UF 25V 20/80% CER Y5V CAP 0805 TR	950-1042951
C6	4.7UF 16V 5MM RADIAL ELECT' CAP TR	155-4751751
C7	SMD 1N5F 50V 10% CER X7R CAP 0805 (TRS)	950-1525621
C8	SMD 330PF 50V 5% CER COG CAP 0805 (TR)	950-3315501
C9	SMD 560PF 50V 5% CER COG CAP 0805 (TR)	950-5615501
C10	SMD 2.7NF 50V 5% CER X7R CAP 0805 (TR)	950-2725521
C11	SMD 3.9NF 50V 10% CER X7R CAP 0805 (TR)	950-3925621
C12	SMD 3.9NF 50V 10% CER X7R CAP 0805 (TR)	950-3925621
C13	SMD 2.7NF 50V 5% CER X7R CAP 0805 (TR)	950-2725521
C14	SMD 1N5F 50V 10% CER X7R CAP 0805 (TRS)	950-1525621
C68	220UF 25V 20% 5MM 105DEG RAD ELEC CAP	855-2272751
C69	SMD 0.1UF 25V 20/80% CER Y5V CAP 0805 TR	950-1042951
C70	2200UF 25V 5MM RADIAL ELECT' CAP	155-2282750
C71	SMD 0.1UF 25V 20/80% CER Y5V CAP 0805 TR	950-1042951
C72	2200UF 25V 5MM RADIAL ELECT' CAP	155-2282750
C73	SMD 0.1UF 25V 20/80% CER Y5V CAP 0805 TR	950-1042951
C74	100UF 50V 20% 105DEG RADIAL ELECT'CAP TR	855-1075751
C76	10UF 16V 5MM RADIAL ELECT' CAP TR	155-1061751
C77	22UF 35V 20% 5MM 105DEG RAD ELEC CAP	855-2263751
C78	220UF 25V 20% 5MM 105DEG RAD ELEC CAP	855-2272751
C79	220UF 25V 20% 5MM 105DEG RAD ELEC CAP	855-2272751
C80	SMD 0.1UF 25V 20/80% CER Y5V CAP 0805 TR	950-1042951
C81	2200UF 25V 5MM RADIAL ELECT' CAP	155-2282750
C82	SMD 0.1UF 25V 20/80% CER Y5V CAP 0805 TR	950-1042951

SPARES - ELECTRICAL PARTS LISTS FOR SOUND BOARD (cont.)

Links cont.

J10	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
LK1 to LK117 are all:		
	TINNED COPPER WIRE LINKS 0.61MM DIA-PMF	999P1099901
except LK47, LK96 to LK104 and LK115 to LK117 which are:		
	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501

Connectors

PL1	FE CONNECTOR - 6 WAY SIDE ENTRY JST	161-2100610
PL2	FE CONNECTOR - 9 WAY SIDE ENTRY JST	161-2100910
PL3	FE CONNECTOR - 7 WAY SIDE ENTRY JST	161-2100710
PL4	PIN HEADER-2WAY FRIC LOCK (JST B 2P-VH)	161-1000204
SK1	LOUD SPKR CONN.BLOCK 8W LQR0810-0008M	163-1081000

Transistors

Q1	SMD TRANSISTOR-BC846B SOT-23	911-1084651
Q2	SMD TRANSISTOR-BC846B SOT-23	911-1084651
Q3	SMD TRANSISTOR-BC846B SOT-23	911-1084651
Q4	SMD TRANSISTOR-BC846B SOT-23	911-1084651
Q5	SMD TRANSISTOR-BC846B SOT-23	911-1084651
Q6	SMD TRANSISTOR-BC856B SOT-23	911-1085651
Q7	SMD TRANSISTOR-BC846B SOT-23	911-1084651
Q8	SMD TRANSISTOR-BC846B SOT-23	911-1084651
Q9	SMD TRANSISTOR-BC846B SOT-23	911-1084651
Q10	SMD TRANSISTOR-BC846B SOT-23	911-1084651
Q11	SMD TRANSISTOR-BC846B SOT-23	911-1084651

Resistors

R1	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R2	SMD 100R 0.1W 5% RES 0805 (TRS)	940-1010501
R3	SMD 1M 0.1W 5% RES 0805 (TRS)	940-1050501
R4	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R5	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R6	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R7	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R8	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R9	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R10	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R11	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R12	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R13	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R14	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R15	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R16	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R17	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R18	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R19	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R20	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R21	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R22	SMD 47K 0.1W 5% RES 0805 (TRS)	940-4730501
R23	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R24	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R25	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R26	SMD 47K 0.1W 5% RES 0805 (TRS)	940-4730501
R27	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R28	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R29	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R30	SMD 47K 0.1W 5% RES 0805 (TRS)	940-4730501
R31	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R32	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R33	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R34	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R35	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R36	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R37	SMD 20R 0.1W 5% RES 0805 (TRS)	940-2000501
R38	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R39	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R40	SMD 4K7 0.1W 5% RES 0805 (TRS)	940-4720501
R41	SMD 4K7 0.1W 5% RES 0805 (TRS)	940-4720501
R42	SMD 4K7 0.1W 5% RES 0805 (TRS)	940-4720501
R43	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R44	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R45	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R46	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R47	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R48	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R49	SMD 1M 0.1W 5% RES 0805 (TRS)	940-1050501
R50	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R51	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R52	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R53	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R54	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R55	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R56	SMD 100R 0.1W 5% RES 0805 (TRS)	940-1010501
R57	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R58	SMD 100R 0.1W 5% RES 0805 (TRS)	940-1010501
R59	SMD 1K 0.1W 5% RES 0805 (TRS)	940-1020501
R60	SMD 1K 0.1W 5% RES 0805 (TRS)	940-1020501
R63	SMD 100R 0.1W 5% RES 0805 (TRS)	940-1010501
R64	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R65	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R66	SMD 100R 0.1W 5% RES 0805 (TRS)	940-1010501
R73	SMD 100K 0.1W 5% RES 0805 (TRS)	940-1040501
R78	SMD 3R9 0.1W 5% RES 0805 (TRS)	940-0390501
R79	SMD 3R9 0.1W 5% RES 0805 (TRS)	940-0390501
R82	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R83	SMD 470K 0.1W 5% RES 0805 (TRS)	940-4740501
R84	SMD 3R9 0.1W 5% RES 0805 (TRS)	940-0390501
R85	SMD 3R9 0.1W 5% RES 0805 (TRS)	940-0390501
R89	SMD 100K 0.1W 5% RES 0805 (TRS)	940-1040501
R105	SMD 4K7 0.1W 5% RES 0805 (TRS)	940-4720501
R106	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R107	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R108	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501

Integrated Circuits

U1	TL084 QUAD BI-FET OP AMP LOW NOISE	100-0008400
U2	HEF4053 TRIPLE 2-CHANNEL MULTIPLEXER	106-0405301
U3	SMD IC - 256K 8 BIT X 32K PS RAM 100NS	904-1025601
U4	SMD IC-DOLBY PROLOGIC PROCESSOR YSS215	909-1021501
U5	TL084 QUAD BI-FET OP AMP LOW NOISE	100-0008400
U6	TEA6330T SOUND FADER CONTROL IC (TR)	909-0633001
U7	TL084 QUAD BI-FET OP AMP LOW NOISE	100-0008400
U8	TL084 QUAD BI-FET OP AMP LOW NOISE	100-0008400
U9	TEA6330T SOUND FADER CONTROL IC (TR)	909-0633001
U10	74HC4316	102-1431600
U11	4280 POWER AMP	100-0428000
U12	4280 POWER AMP	100-0428000

Miscellaneous Components

X1	11.2896MHZ QUARTZ CRYSTAL	170-0112890
HS1	HEATSINK-6063 ALLOY MSS1000 SUR/SOUND	202-0606300
2 OFF	SPRING CLIP - 4597 MSS1000 AUDIO HEATSINK	249-0459700
FIT TO U11		
	KEROTHERM PAD TYPE 86/30 (14X19MM)	208-0863001
FIT TO U12		
	KEROTHERM PAD TYPE 86/30 (14X19MM)	208-0863001
3 OFF	SNAP RIVET-SR3555B BLACK PLASTIC RICHCO	247-3555111
1 OFF	COVER-VAC FORMED FOR MSS AUDIO PCB-ISS2	312-1001219

SPARES - ELECTRICAL PARTS LIST FOR CARD READER BOARD

Capacitors

C1	SMD 47PF 50V 5% CER COG CAP 0805 (TRS)	950-4705501
C2	SMD 47PF 50V 5% CER COG CAP 0805 (TRS)	950-4705501
C3	SMD 0.1UF 25V 20/80% CER Y5V CAP 0805 TR	950-1042951
C4	SMD 0.1UF 25V 20/80% CER Y5V CAP 0805 TR	950-1042951
C5	10UF 16V 5MM RADIAL ELECT' CAP TR	155-1061751
C6	SMD 0.1UF 25V 20/80% CER Y5V CAP 0805 TR	950-1042951
C7	SMD 0.1UF 25V 20/80% CER Y5V CAP 0805 TR	950-1042951
C9	10UF 16V 5MM RADIAL ELECT' CAP TR	155-1061751
C10	SMD 0.1UF 25V 20/80% CER Y5V CAP 0805 TR	950-1042951
C11	SMD 47NF 50V 10% CER X7R CAP 0805 (TRS)	950-4735621
C12	SMD 10NF 50V 10% CER X7R CAP 0805 (TRS)	950-1035621
C13	SMD 10NF 50V 10% CER X7R CAP 0805 (TRS)	950-1035621
C14	SMD 10NF 50V 10% CER X7R CAP 0805 (TRS)	950-1035621
C15	SMD 47NF 50V 10% CER X7R CAP 0805 (TRS)	950-4735621

Diodes

D1	SMD DIODE-BAS16/DAN212KT146 SOT-23	912-0001651
D2	SMD DIODE-BAS16/DAN212KT146 SOT-23	912-0001651
D3	SMD DIODE-BAS16/DAN212KT146 SOT-23	912-0001651
D4	SMD DIODE-BAS16/DAN212KT146 SOT-23	912-0001651
D5	SMD DIODE-BAS16/DAN212KT146 SOT-23	912-0001651
D6	SMD DIODE-BAS16/DAN212KT146 SOT-23	912-0001651
D7	SMD DIODE-BAS16/DAN212KT146 SOT-23	912-0001651
D8	SMD DIODE-BAS16/DAN212KT146 SOT-23	912-0001651

Connectors

PL1	FE CONNECTOR -11 WAY TOP ENTRY JST	161-2001110
PL2	FE CONNECTOR - 8 WAY TOP ENTRY JST	161-2000810

Transistors

Q1	SMD TRANSISTOR-BC846B SOT-23	911-1084651
Q2	SMD TRANSISTOR-BC846B SOT-23	911-1084651
Q3	TRANSISTOR-FXT749 (ZETEX) TR	110-0074911
Q4	TRANSISTOR-FXT749 (ZETEX) TR	110-0074911
Q5	SMD TRANSISTOR-BC846B SOT-23	911-1084651
Q6	TRANSISTOR-FXT749 (ZETEX) TR	110-0074911
Q7	SMD TRANSISTOR-BC846B SOT-23	911-1084651
Q8	TRANSISTOR-FXT749 (ZETEX) TR	110-0074911

Resistors

R1	SMD 1K8 0.1W 5% RES 0805 (TRS)	940-1820501
R2	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R6	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R7	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R8	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R9	SMD 4K7 0.1W 5% RES 0805 (TRS)	940-4720501
R10	SMD 1K 0.1W 5% RES 0805 (TRS)	940-1020501
R11	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R12	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R13	SMD 4K7 0.1W 5% RES 0805 (TRS)	940-4720501
R14	SMD 1K 0.1W 5% RES 0805 (TRS)	940-1020501
R15	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R17	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R18	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R19	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R20	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R21	SMD 100K 0.1W 5% RES 0805 (TRS)	940-1040501
R22	SMD 100K 0.1W 5% RES 0805 (TRS)	940-1040501
R23	SMD 100K 0.1W 5% RES 0805 (TRS)	940-1040501
R24	SMD 100K 0.1W 5% RES 0805 (TRS)	940-1040501
R25	SMD 100K 0.1W 5% RES 0805 (TRS)	940-1040501
R26	SMD 100K 0.1W 5% RES 0805 (TRS)	940-1040501
R27	SMD 100K 0.1W 5% RES 0805 (TRS)	940-1040501
R28	SMD 100K 0.1W 5% RES 0805 (TRS)	940-1040501
R29	SMD 100K 0.1W 5% RES 0805 (TRS)	940-1040501
R30	SMD 100K 0.1W 5% RES 0805 (TRS)	940-1040501
R31	SMD 100K 0.1W 5% RES 0805 (TRS)	940-1040501
R32	SMD 100K 0.1W 5% RES 0805 (TRS)	940-1040501
R33	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R34	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R35	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R36	SMD 100K 0.1W 5% RES 0805 (TRS)	940-1040501
R37	SMD 470R 0.1W 5% RES 0805 (TRS)	940-4710501
R38	SMD 100K 0.1W 5% RES 0805 (TRS)	940-1040501
R39	SMD 470R 0.1W 5% RES 0805 (TRS)	940-4710501
R40	4R7 0.5W 1% METAL FILM RES TR	141-0475101

Integrated Circuits

U1	SMD IC-4053 SO-16 TR	906-0405302
U2	SMD IC-4053 SO-16 TR	906-0405302
U3	(A VIDEOCRYPT COMPONENT)	109-0011301
U4	SMD IC-74HC04 (TR)	902-2000401

Miscellaneous Components

CARD1	SMART CARD READER-ALCATEL7001LM0416T2F08	870-7001001
CARD2	SMART CARD READER-ALCATEL7001LM0416T2F08	870-7001001

SPARES - ELECTRICAL PARTS LIST FOR U22 EXTENSION BOARD

C1	1UF 50V 5MM M/LAYER CER.CAP TR	157-1055751
C2	100NF 50V 5MM M/LAYER CER.CAP TR	157-1045751
C3	100NF 50V 5MM M/LAYER CER.CAP TR	157-1045751
C4	100NF 50V 5MM M/LAYER CER.CAP TR	157-1045751
C5	33PF 16V 5MM CERAMIC CAP 10% TR	150-3301651
C6	39PF 16V 5MM CERAMIC CAP 10% TR	150-3901651
J1	TINNED COPPER WIRE LINKS 0.61MM DIA-PMF	999P1099901
PL 1	PIN HEADER-20 WAY EXTENDED S/ROW(SAMTEC)	161-1002002

Note: 2 of these connectors are fitted to make up PL1

U1	SMD IC-Z86C9620VSC ROMLESS Z8	904-0869601
U3	74HC374	102-1037400
FIT TO U4		
	SOCKET-28 PIN IC DIL	209-2002800
X1	XTAL 16MHZ HC18U 50/50/-10+60 30PF PAR	170-0160000
FIT TO X1		
	INS.WASHER-FOR HC18/49 (HOLED) XTAL CAN	208-0153000

SPARES - ELECTRICAL PARTS LIST FOR DISPLAY BOARD

Capacitors

C1	100UF 25V 2.5MM RADIAL ELECT' CAP TR	155-1072721
C2	1UF 50V 5MM 20% MINI RAD ELEC' CAP TR	156-1055751
C3	SMD 33PF 50V 5% CER COG CAP 0805 (TRS)	950-3305501
C4	SMD 33PF 50V 5% CER COG CAP 0805 (TRS)	950-3305501
C5	470UF 6.3V 2.5MM RADIAL ELECT' CAP TR	155-4770721
C6	SMD 0.1UF 25V 20/80% CER Y5V CAP 0805 TR	950-1042951
C7	SMD 0.1UF 25V 20/80% CER Y5V CAP 0805 TR	950-1042951
C8	SMD 0.1UF 25V 20/80% CER Y5V CAP 0805 TR	950-1042951
C10	SMD 0.1UF 25V 20/80% CER Y5V CAP 0805 TR	950-1042951
C11	10UF 50V 20% 5MM MINI RAD ELECT' CAP TR	156-1065751
C12	10UF 50V 20% 5MM MINI RAD ELECT' CAP TR	156-1065751
C14	SMD 0.1UF 25V 20/80% CER Y5V CAP 0805 TR	950-1042951
C15	SMD 1NF 50V 5% CER COG CAP 0805 (TRS)	950-1025501
C16	SMD 1NF 50V 5% CER COG CAP 0805 (TRS)	950-1025501
C17	SMD 1NF 50V 5% CER COG CAP 0805 (TRS)	950-1025501
C18	330UF 25V 3.5MM RADIAL ELECT' CAP TR	155-3372731
C19	SMD 220NF 25V 20/80% CER Y5V CAP 0805 TR	950-2242951
C20	SMD 220NF 25V 20/80% CER Y5V CAP 0805 TR	950-2242951
C21	SMD 220NF 25V 20/80% CER Y5V CAP 0805 TR	950-2242951
C22	100NF 50V 5MM M/LAYER CER CAP 10% TR	157-1045651

Diodes

D1	SMD DIODE-BAR43 SOT-23 (TRS)	912-0004351
D2	SMD DIODE-BAR43 SOT-23 (TRS)	912-0004351
D3	SMD DIODE-BAR43 SOT-23 (TRS)	912-0004351
D4	SMD DIODE-BAR43 SOT-23 (TRS)	912-0004351
D5	2V4 5% 400MW ZENER DIODE TR	125-0024501

Inductors

L1	AXIAL INDUCTOR-18UH 10% DC RES <0.8R TR	130-0180611

Links

J1	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
LK1 to LK49 are all:		
	TINNED COPPER WIRE LINKS 0.61MM DIA-PMF	999P1099901
LK50 to LK63 are all:		
	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501

Connectors

PL1	FE CONNECTOR - 10 WAY SIDE ENTRY JST	161-2101010
PL2 to PL3		
	CABLE ASSY-3WAY 75MM MSS DISP BOARD	266-1000030

Transistors

Q1	SMD TRANSISTOR-BC856B SOT-23	911-1085651
Q2	SMD TRANSISTOR-BC856B SOT-23	911-1085651
Q3	SMD TRANSISTOR-BC856B SOT-23	911-1085651
Q4	SMD TRANSISTOR-BC856B SOT-23	911-1085651
Q5	TRANSISTOR-BC557 PNP TO-92 PACKAGE TR	110-0055701
Q6	TRANSISTOR-BC547B NPN TO-92 PACKAGE TR	110-1054701
Q7	SMD TRANSISTOR-BC856B SOT-23	911-1085651
Q8	SMD TRANSISTOR-BC856B SOT-23	911-1085651
Q9	SMD TRANSISTOR-BC856B SOT-23	911-1085651
Q10	SMD TRANSISTOR-BC856B SOT-23	911-1085651

Resistors

R1	SMD 470R 0.1W 5% RES 0805 (TRS)	940-4710501
R2	SMD 220R 0.1W 5% RES 0805 (TRS)	940-2210501
R3	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R4	SMD 1K8 0.1W 5% RES 0805 (TRS)	940-1820501
R5	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R6	SMD 1K8 0.1W 5% RES 0805 (TRS)	940-1820501
R7	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R8	SMD 1K8 0.1W 5% RES 0805 (TRS)	940-1820501
R9	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R10	SMD 1K8 0.1W 5% RES 0805 (TRS)	940-1820501
R13	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R14	SMD 1K8 0.1W 5% RES 0805 (TRS)	940-1820501
R15	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R16	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R17	SMD 47K 0.1W 5% RES 0805 (TRS)	940-4730501
R18	SMD 47K 0.1W 5% RES 0805 (TRS)	940-4730501
R19	SMD 47K 0.1W 5% RES 0805 (TRS)	940-4730501
R20	SMD 47K 0.1W 5% RES 0805 (TRS)	940-4730501
R21	SMD 47K 0.1W 5% RES 0805 (TRS)	940-4730501
R22	SMD 560R 0.1W 5% RES 0805 (TRS)	940-5610501
R23	SMD 560R 0.1W 5% RES 0805 (TRS)	940-5610501
R24	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R25	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R26	SMD 4K7 0.1W 5% RES 0805 (TRS)	940-4720501
R27	SMD 560R 0.1W 5% RES 0805 (TRS)	940-5610501
R29	SMD 0.1W 5% ZEROHM LINK-0805 (TRS)	940-0000501
R30	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R31	SMD 10K 0.1W 5% RES-0805 (TRS)	940-1030501
R32	SMD 470R 0.1W 5% RES 0805 (TRS)	940-4710501
R33	SMD 470R 0.1W 5% RES 0805 (TRS)	940-4710501
R34	SMD 220R 0.1W 5% RES 0805 (TRS)	940-2210501
R36	SMD 470R 0.1W 5% RES 0805 (TRS)	940-4710501
R37	SMD 1K 0.1W 5% RES 0805 (TRS)	940-1020501
R38	22R 1W 5% METAL FILM RES TR	141-2206501

Switches

SW1	SWITCH-B3F1005 PCB STANDARD	204-0100501
SW2	SWITCH-B3F1005 PCB STANDARD	204-0100501
SW3	SWITCH-B3F1005 PCB STANDARD	204-0100501
SW4	SWITCH-B3F1005 PCB STANDARD	204-0100501
SW5	FUNCTION CONT ECWOJ-C24-BE0024(200K-CYC)	146-0002420

Integrated Circuits

U1	PANASONIC MICRO MN158418PCEM MSS1000	809-1584001

Miscellaneous Components

IR1	SONY INFRA-RED REC MODULE (SBX 1610-E2)	215-1610002
LED1	LED-GREEN 2MM TOWER TYPE 103 SERIES H/EF	200-2110201
LED2	LED-GREEN 2MM TOWER TYPE 103 SERIES H/EF	200-2110201
VFD1	VAC/FLUORESCENT DISP 11-MT-91GK ISSUE C	200-0119100
X1	XTAL-4MHZ HC49/4H 20/50/10/30 LO PROFILE	170-0040010
2 OFF	LED SUPPORT CLIP MSS1000	249-1000100
1 OFF	VFD DISPLAY SUPPORT CLIP (RHS) MSS1000	249-1001100
1 OFF	VFD DISPLAY SUPPORT CLIP (LHS) MSS1000	249-1002100

SPARES - MECHANICAL PARTS LIST

Note: some mechanical parts also appear in the "Miscellaneous Components" section of the parts lists for individual boards.

1 OFF	BAG-POLYTHENE 20X17" FOR MSS1000 UNIT	400-1201700
1 OFF	BAG-POLYTHENE FOR LEADS	400-1080400
2 OFF	BATTERY-1.5V AAA	239-0015000
1 OFF	COMPRESSION RING FOR MSS1000 KNOB	241-1000100
1 OFF	FUNCTION CNTL KNOB FOR MSS1000 SERIES	204-1000100
2 OFF	MODULATOR SCREENING CAN-TOP REV I	315-0235001
1 OFF	MSS REMOVE PROTECTIVE FILM F/P LABEL	299-1001401
4 OFF	NEOPREEN PAD-TF1015 15MMDIA X 6MM THICK	208-1015011
6 OFF	SNAP RIVET-SR3555B BLACK PLASTIC RICHCO	247-3555111

FOR YOUR OWN SERVICE NOTES

SPARES - UNIQUE ELECTRICAL PARTS LIST

U22 Extension Board

U4	EPROM-27256 MSS1000 ENG V5 (805-1000105)	805-1000105

Main Board

PL1	FE CONNECTOR - 6 WAY TOP ENTRY JST	161-2000610
PL2	FE CONNECTOR-10 WAY TOP ENTRY FE-10-BT	161-2001010
PL3	FE CONNECTOR - 7 WAY TOP ENTRY JST	161-2000710
PL4	FE CONNECTOR - 9 WAY TOP ENTRY JST	161-2000910
PL7	FE CONNECTOR -11 WAY TOP ENTRY JST	161-2001110
PL12	FE CONNECTOR - 8 WAY TOP ENTRY JST	161-2000810
PL38	PIN HEADER-2WAY FRIC LOCK (JST B 2P-VH)	161-1000204
TUNER 1		
	PACE PG77G01 2GHZ D/LNB FIXED 'F' TUNER	221-2177012

Retrofitted Components on Main Board

Fitted between pins 5 and 14 of U26 (ECO S000482 -see page 5)

330PF 100V 5MM CERAMIC CAP 20% TR 150-3317751

Fitted between C260 and a cut track (ECO S000498 - see page 5)

CABLE-55/0.1MM (0.43MM SQ) PVC YELLOW 190-5501210

Retrofitted Components on Sound Board

Fitted as described in ECO S000535 and PCO S000243 - see page 5

MOD WIRE 0.5MM X 20MM RED 190-0502015

SPARES - UNIQUE MECHANICAL PARTS LIST

1 OFF	"ATTENTION INSTALLERS" MSS1000 ENG/GER	504-8661001
1 OFF	"DOLBY","PROLOGIC" TRADEMARK LABEL	299-1000219
1 OFF△	"A" UK MAINS LEAD 3A 3P/PLUG (BLACK)	191-1180280
1 OFF△	"A"MANUAL MSS1001-I V/CRYPT UK PACE ISS3	502-1010102
1 OFF△	"A"START-UP GUIDE - MSS1001-I MANUAL IS	504-2010102
1 OFF	BASE - MSS1000 UNIVERSAL (NO PWR RATING)	321-1000101
1 OFF	BLANKING PLUG MSS1000 IRTE+DISH POSITION	306-1001100
1 OFF	CABLE ASSY - COAX DOLBY POWER 425MM	266-1000022
1 OFF	CABLE-10WAY 230MM MSS1000 DISPLAY FFC	198-0230100
1 OFF	CABLE-11WAY 200MM MSS1000 CARD READ FFC	198-0200110
1 OFF	CABLE-6WAY 150MM MSS1000 DOLBY (1) FFC	198-0150060
1 OFF	CABLE-7WAY 180MM MSS1000 DOLBY FFC	198-0180070
1 OFF	CABLE-8WAY 154MM MSS1000 CARD READ FFC	198-0154080
1 OFF	CABLE-9WAY 150MM MSS1000 DOLBY FFC	198-0150090
1 OFF	CABLE-COAX UHF MALE TO FEMALE	198-0015021
1 OFF	CARDBOARD INTERNAL FITMENT MSS SERIES	444-1000101
1 OFF	CARTON - MSS1000 SERIES PACE - UK	412-1000100
1 OFF	COVER-MSS1000 SERIES-FRONT PANEL FINISH	312-1000001
1 OFF	FRONT PANEL MSS1001-I V/CRT 2CRD PACE V2	360-1112101
1 OFF	HANDLE/BACKING PLATE-MSS1000/500-CARTON	444-1500000
1 OFF	LABEL - ENHANCED LNB SOFTWARE	299-8661022
1 OFF	MSS1000 HANDSET BRANDED PACE	699-1000100
2 OFF	PILLAR - MSS1000 SUPPORT-PCB AMP/DISH	248-5080100
1 OFF	PILLAR-LCBS-14 (RICHCO)	248-0014002
12 OFF	PLASTITE SCREW-4 X 1/4 POZI PAN BLACK	245-4140011
1 OFF	PROG LIST SHEET-MSS1000 V/CRYPT UK PACE	504-1010101
8 OFF	SCREW-M3 X 8 P/P TAP.C/W WASHER BLK SEAL	246-3080011

CHANGES TO PARTS LISTS CAUSED BY RECENT ECOS (i.e. AFTER 28.03.94)

Changes to Electrical Parts:

In ECO S000543, R115 on main board changes to become:

R115 1R 1WATT 5% METOX NON-SPIRAL RES 143-0106521

In ECO S000549, C6 on U22 extension PCB changes to become:

C6 47PF 50V 5% CERAMIC CAP TR 150-4705551

In ECO S000347, switches SW1, SW2, SW3, SW4 on display board change to become:

SW1-4 SWITCH - B3F1005 PCB STANDARD (TR) 204-0100502

In ECO S000556, R37 is deleted from the display board and the following components change to become:

C2	100UF 25V 5MM RADIAL ELECT' CAP TR	155-1072751
R36	SMD 0.1W 5% ZEROHM LINK - 0805 (TRS)	940-0000501
R38	22R 1W 5% CARBON FILM RES TR	140-2206501
Q5**	TRANSISTOR - ZTX749 (ZETEX)	110-1074911
Q6**	TRANSISTOR - ZTX314E - LINE PACK ZETEX	110-0031411

** NOTE: For the A2 and A3 revisions of the PCB, Q5 and Q6 must be fitted the opposite way round to the way indicated by the component ident on the PCB (when ECO S000556 is implemented).

In PCO S000233A, the following capacitors on sound board change to become:

C2	2200UF 16V 5MM RADIAL ELECT' CAP	155-2281750
C61	2200UF 16V 5MM RADIAL ELECT' CAP	155-2281750
C111	2200UF 16V 5MM RADIAL ELECT' CAP	155-2281750
C70	2200UF 25V DJ3 ±20% RADIAL ELECT' CAP	855-2282960
C72	2200UF 25V DJ3 ±20% RADIAL ELECT' CAP	855-2282960
C81	2200UF 25V DJ3 ±20% RADIAL ELECT' CAP	855-2282960
C83	2200UF 25V DJ3 ±20% RADIAL ELECT' CAP	855-2282960

In PCO S000234, the following capacitors on display board change to become:

C1	100UF 25V 2.5MM RADIAL ELECT' CAP	155-1072720
C5	470UF 6.3 2.5MM RADIAL ELECT' CAP	155-4770720

Changes to Mechanical Parts:

In ECO S000515, the 4 off neopreen pads are replaced by:

4 OFF SELF-ADHESIVE FOOT (MOULDED BLACK) 208-0001400

In ECO S000545, the polythene packing bag changes to become:

1 OFF BAG - POLYTHENE 400 X 330 FOR MSS1000 UNIT 400-4403300

In ECO S000447, the cover for the sound board becomes:

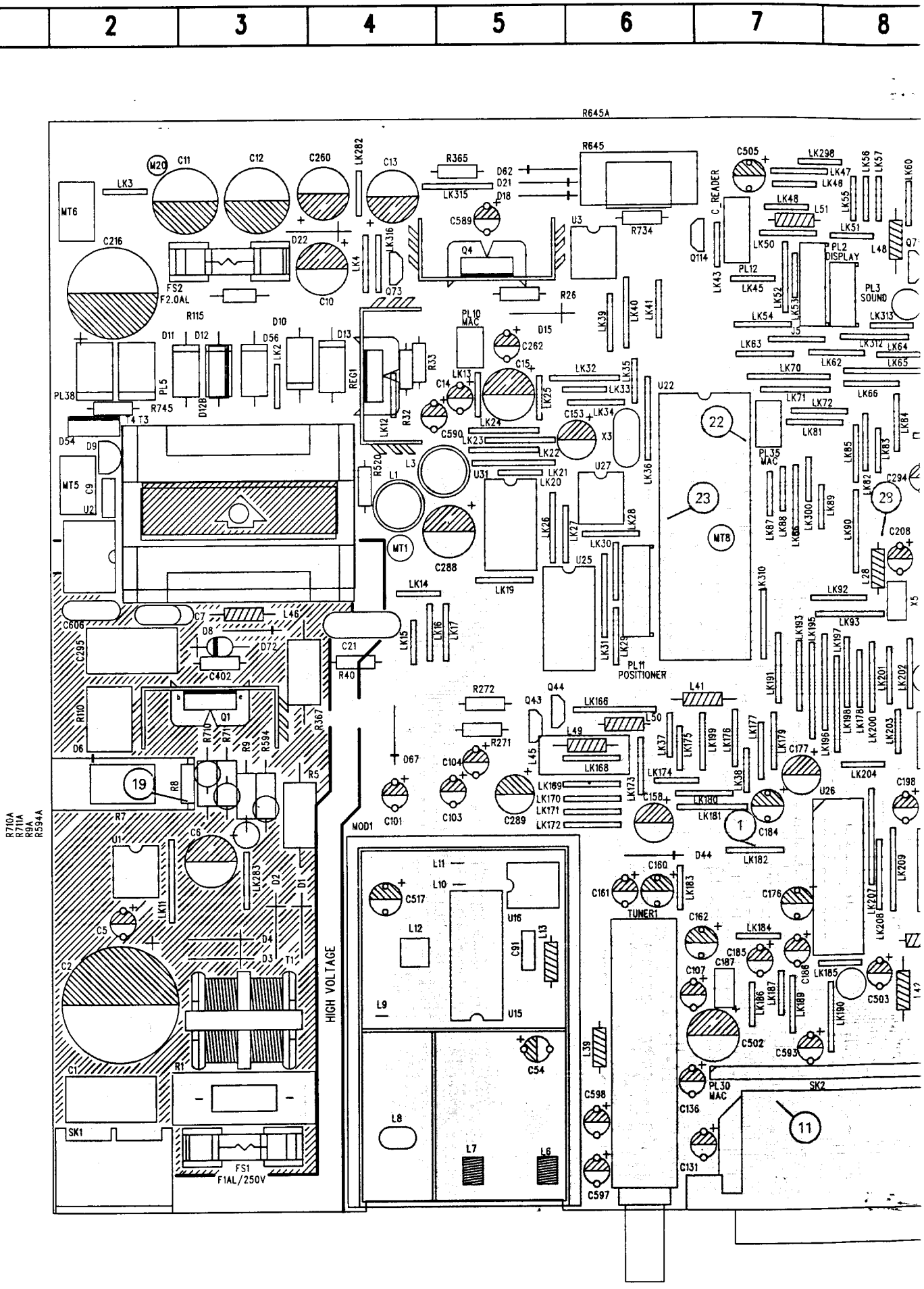
1 OFF COVER - VAC FORMED FOR MSS AUDIO - HI TEMP 312-1002219

In ECO S000245, the following is added to the parts list:

1 OFF UNBRANDED "HOME CINEMA GUIDE" MSS1000 UK 504-1000100

FOR YOUR OWN SERVICE NOTES

MAIN BOARD IDENT DIAGRAM - COMPONENT SIDE



T SIDE

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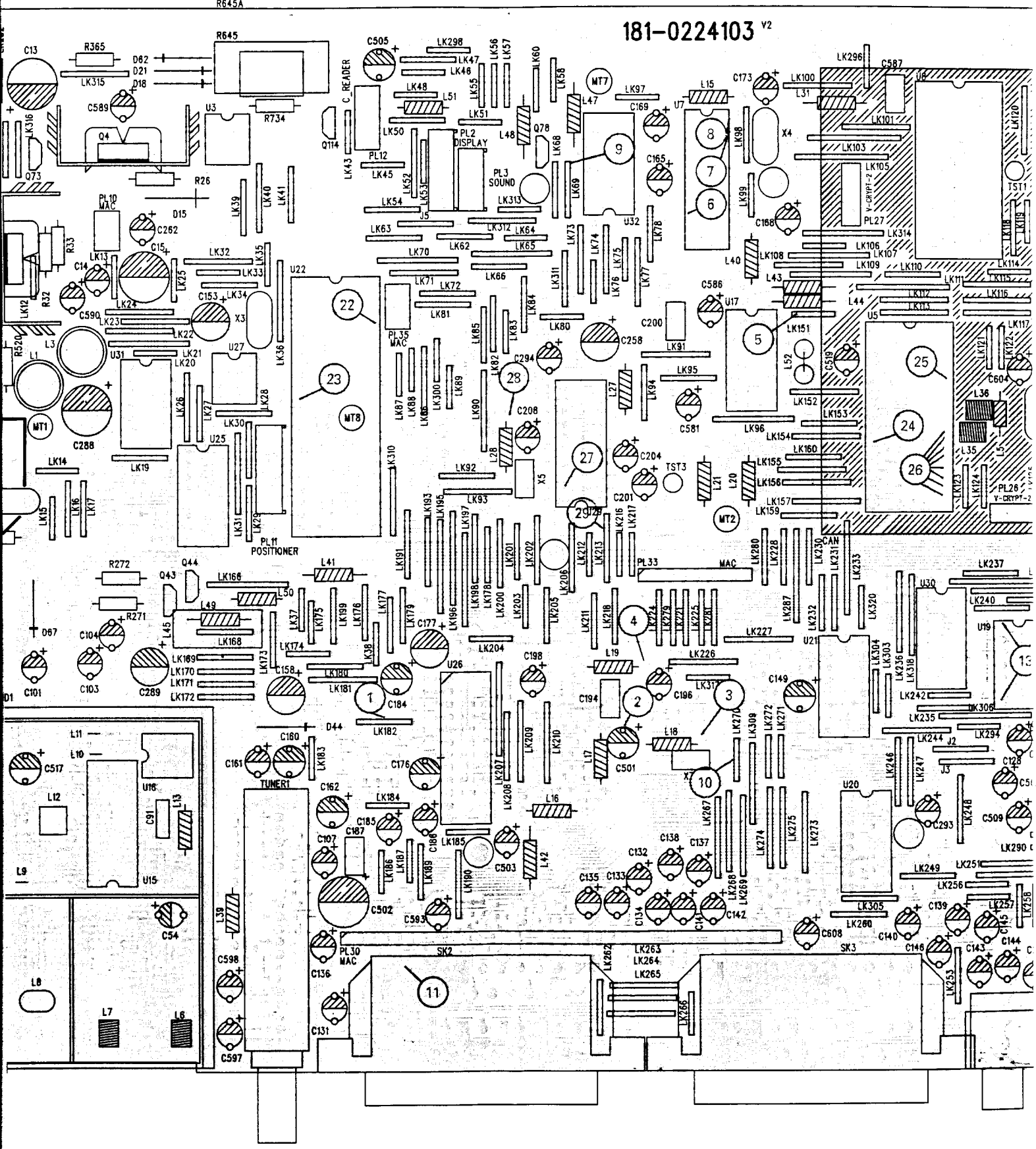
181-0224103 V2
R645A
R645
R365
C13
C589
R734
U3
Q4
Q73
R26
C262
C15
C14
C590
X3
U22
U27
U31
U25
C288
MT1
MT8
PL11
POSITIONER
PL35
MAC
C_READER
Q114
PL2
DISPLAY
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SOUND
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MAC
C505
MT7
U32
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C169
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C586
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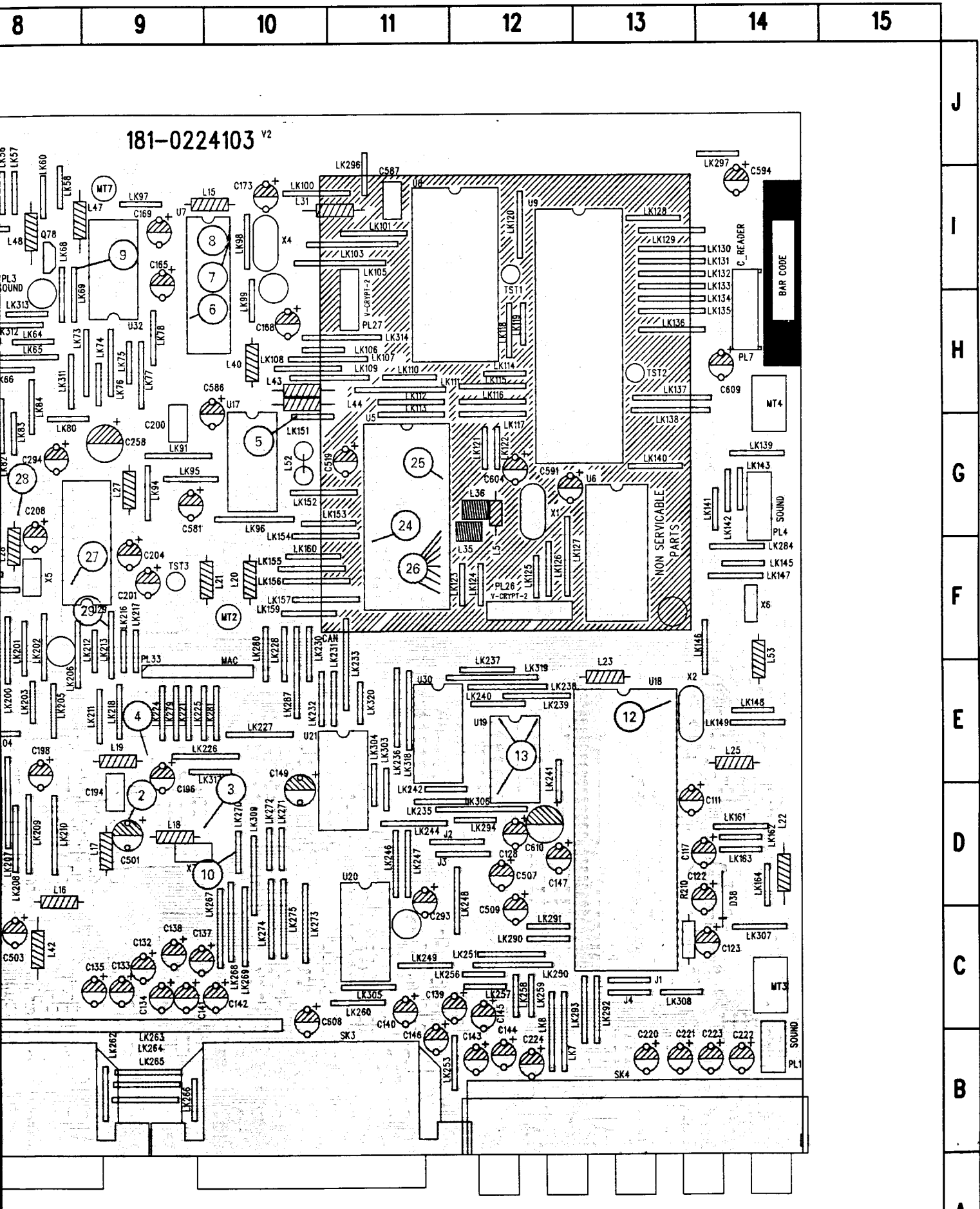
181-0224103 V2
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D
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A
BAR CODE
C_READER
NON SERVICABLE PARTS
V-CRYPT-2
PL26
PL27
PL33
MAC
CAN
SOUND
PL4
PL7
PL1
MT2
MT3
MT4
MT7
TST1
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